PUBLIC NOTICE

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of Engineers ®
New England District

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Concord, MA 01742-2751

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PROPOSED REVISION OF NEW ENGLAND DISTRICT COMPENSATORY MITIGATION GUIDANCE

This notice concerns guidance for compensatory mitigation for impacts to aquatic resources associated with Department of the Army permits in New England. Both the U.S. Army Corps of Engineers (Corps) and U.S. Environmental Protection Agency have a national goal of no overall net loss of wetland functions. This goal is achieved through mitigation of aquatic resource impacts. Mitigation includes a sequence of avoidance, minimization, and finally compensation. This proposal does not alter that sequencing in any way; however, the terms "mitigation" and "compensation" are here used interchangeably to refer to compensatory mitigation.

The Corps New England District (District) has periodically revised and updated its compensatory mitigation guidance, most recently July 20, 2010. These revisions are generally for a variety of reasons, including incorporating new national guidance and directives, improved methodologies, and updated technical information. A combination of these has prompted this current revision.

There are several notable changes in the proposed guidance. It has been restructured so the overall compensatory mitigation guidance is the primary portion of the document and the mitigation plan checklist and checklist directions for each of the resource-specific modules is included in its own appendix. The resource modules for vernal pools and streams have been improved and extended. Detailed methods for calculating appropriate compensatory mitigation for impacts to these resources are included. Some of the existing compensation ratios are proposed for change, particularly where only a range of ratios had been present. In addition, a number of smaller, mostly editorial changes have been made.

For the stream module, we are particularly seeking feedback on the overall approach, as well as the specific details.

Preliminary review of the proposed compensatory mitigation guidance revisions indicates that: 1) no environmental impact statement will be required; 2) implementation will not affect any species listed as threatened or endangered under the Endangered Species Act of 1973 (PL 93-205); and 3) no cultural or historic resources considered eligible or potentially eligible for listing on the National Register of Historic Places will be affected.

Public comments on the proposed revisions post-marked by May 4, 2015, will be considered. The comments will be addressed prior to final issuance. Anyone wishing to

comment is encouraged to do so. Any questions or comments regarding the District compensatory mitigation guidance revisions should be directed to Ruth Ladd at ruth.m.ladd@usace.army.mil, (978) 318-8818, (800) 343-4789, or, if calling from within Massachusetts, (800) 362-4367.

Any person may request, in writing, within the comment period specified in this notice, that a public hearing be held to consider this guidance. Requests for a public hearing shall specifically state the reasons for holding a public hearing. The Corps holds public hearings for the purpose of obtaining public comments when that is the best means for understanding a wide variety of concerns from a diverse segment of the public.

The preliminary determinations made herein will be reviewed in light of facts submitted in response to this notice. All comments will be considered a matter of public record.

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Acting Chief, Regulatory Division

If you would prefer not to continue receiving Public Notices, please contact Ms. Tina Chaisson at (978) 318-8058 or e-mail her at bettina.m.chaisson@usace.army.mil. You may also check here ( ) and return this portion of the Public Notice to: Bettina Chaisson, Regulatory Division, U.S. Army Corps of Engineers, 696 Virginia Road, Concord, MA 01742-2751.

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US Army Corps of Engineers®
New England District

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I. GENERAL GUIDANCE

I.1. Purpose and General Considerations

Applicants should contact the Corps prior to initiation of mitigation site selection and mitigation plan development because mitigation requirements are project-specific and appropriate site selection is critical to mitigation success. This New England District Guidance is for use when the Corps determines permittee-responsible compensatory mitigation is appropriate for a particular project and for third party mitigation projects (mitigation banks and In-lieu Fee (ILF) programs). *When a mitigation bank or an ILF program is available, compensatory mitigation conducted using these options are considered preferable to permittee-responsible alternatives unless the permittee can make the case that a permittee-responsible mitigation project is more ecologically appropriate based on the needs of the watershed, sustainability, and/or has a higher likelihood of replacing lost aquatic resource functions.* This document represents New England District guidance and incorporates the requirements of the following documents (NOTE: previous versions of our guidance included web links for these and many other references; however, due to the speed and frequency with which these links become obsolete, they provided more confusion than benefit. An internet search will provide more accurate and quicker access to these documents.):

1. Compensatory Mitigation for Losses of Aquatic Resources; Final Rule 4/10/08; 33 CFR Parts 325 and 332 ("Mitigation Rule")
2. Regulatory Guidance Letter 08-03: Minimum Monitoring Requirements for Compensatory Mitigation Projects Involving the Restoration, Establishment, and/or Enhancement of Aquatic Resources

The Council on Environmental Quality (CEQ) has defined mitigation in its regulations at 40 CFR 1508.20 to include: avoiding impacts, minimizing impacts, rectifying impacts, reducing impacts over time, and compensating for impacts. The Clean Water Act Section 404(b)(1) Guidelines (40 CFR 230) establish the environmental criteria by which activities are permitted under Section 404, including sequencing to reduce project impacts on the aquatic environment. This sequencing hierarchy starts with avoiding impacts to aquatic resources to the extent practicable, minimizing unavoidable impacts, and finally, compensating for any remaining unavoidable impacts to aquatic resources. Both the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency have a national goal of no overall net loss of wetland functions, as explained in the agencies' 1990 Memorandum of Understanding and the Mitigation Rule. This goal is to be achieved through compensatory mitigation of aquatic resource impacts. These guidelines use the terms "mitigation" and "compensation" interchangeably to refer to compensatory mitigation.

The purpose of this document is twofold:

1. To provide guidance to the regulated community on the requirements for mitigation required by the Corps of Engineers, New England District, and
2. To provide a standardized format for the Corps to use in reviewing mitigation plans for their technical merit and ability to replace impacted functions.

It is important to note that there is flexibility in this guidance. When variances are necessary, the proposed mitigation plan should provide a simple explanation of the rationale for the variance(s). However, some items are required by regulation or policy and are indicated by use of the term "must." We acknowledge that there is no "one size fits all" when planning compensatory mitigation because environmental stressors at mitigation sites will vary from one another relative to current land use and historic impacts at both the site and watershed scales, thus requiring that mitigation approaches be adapted to the site-specific conditions. A successful mitigation project requires careful design, detailed review, commonsense oversight during construction by a person well versed in wetland or other applicable science (e.g., stream morphology, submerged aquatic vegetation ecology, vernal pool ecology), and effective and comprehensive adaptive management (e.g., invasive species removal).

The checklists and checklist directions are intended to help focus mitigation plans on the topics, items, and specific information needed for the Corps to perform a thorough review of proposed mitigation. The general checklist is intended for use with all projects, while the specific aquatic resource checklists are designed to note the required information unique to each resource.

I.2. General Compensatory Mitigation Requirements

2.a. Temporal Losses

All projects that have not provided mitigation in advance of impacts will result in temporal losses in function that occur between the time aquatic resource functions are lost due to the project impacts and the time they are generated to a similar degree in compensatory mitigation. For example, the wildlife and ecosystem support functions of forested wetlands may take 30-50 years or more to develop and eelgrass habitat functions may take 5 years or more to develop (Evans and Short, 2005). Applicants should be aware that additional compensation will likely be required to offset temporal losses.

Wetland functions vary in the amount of time it typically takes to restore them, due to a variety of factors, including the degree of degradation, wetland type, climate, surrounding land cover/land use, and the specific function under consideration (physical vs. biological). Examples of wetland functions that may recover quickly are flood storage and groundwater discharge and/or recharge. While sediment trapping functions may develop relatively quickly, water quality functions involving biogeochemical transformations can take many years to develop because they depend upon the chemical and biological characteristics of the wetland soils, mainly the relative availability of organic matter. The amount and type of additional compensation will depend upon the type of functions impacted, the type of aquatic resource proposed, the functions intended, and any pre-existing conditions that may influence the development of the desired aquatic resource(s). Such compensation may include increased area for aquatic resource establishment (creation), reestablishment (restoration), or rehabilitation or it may be solely additional preservation.

As is the case for wetland functions, some stream functions also vary in the amount of time it typically takes to restore them. Restoration of functions related to physical conditions, such as expanding fish access to upstream habitat and restoration of natural streamflow can be restored relatively quickly, whereas functions related to the development of detrital biomass may take longer. Likewise, compensation for temporal losses in functioning will likely be required.

Aquatic resource mitigation can be complicated and unforeseen outcomes can frequently occur. An adaptive management approach involves exploring alternative ways to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, implementing one or more of these alternatives, monitoring to learn about the impacts of management actions, and then using the results to update knowledge and adjust management actions (Williams et al. 2009).

For example, pilot studies might compare various potential treatments to help determine the most successful mitigation approach. Such an approach requires detailed planning, effective implementation of the plan, close monitoring, adjusting to intermediate results, and making additional modifications when needed to reach the long-term goals.

2.b. General Compensatory Mitigation Concepts

In order to more closely replace impacted functions, in-kind mitigation is generally preferred to out-of-kind mitigation for impacted resources that are not heavily degraded, provided this is appropriate based on watershed scale considerations. Out-of-kind mitigation may be preferred for heavily degraded systems or where it would be more beneficial to the overall watershed (at the U.S.G.S. Hydrologic Unit Code Level 8 or 10) or other appropriate project-specific boundary. Compensation should generally be located where it is most likely to be successful in providing the desired aquatic resource functions, taking into account aquatic habitat diversity, connectivity, and, for wetlands and streams, a natural balance of aquatic resources and uplands. Compensation should not be located in positions that will be detrimental to the compensation site (e.g., some on-site compensatory mitigation functions may be degraded by proximity to the project). Some functions (e.g., floodflow alteration) may need to be mitigated on-site, while others (e.g., wildlife and/or fisheries habitat) should be mitigated off-site in most cases. If more than one compensation site is to be used, they do not need to be contiguous with each other. Again, overall watershed scale considerations may dictate the most appropriate location for compensatory mitigation projects.

The Mitigation Rule also emphasizes the use of a watershed approach to siting mitigation projects. It defines watershed approach as "an analytical process for making compensatory mitigation decisions that support the sustainability or improvement of aquatic resources in a watershed. It involves consideration of watershed needs, and how locations and types of compensatory mitigation projects address those needs. A landscape perspective is used to identify the types and locations of compensatory mitigation projects that will benefit the watershed and offset losses of aquatic resource functions and services caused by activities authorized by Department of Army (DA) permits. The watershed approach may involve consideration of landscape scale, historic and potential aquatic resource conditions, past and projected aquatic resource impacts in the watershed, and terrestrial connections between aquatic resources when determining compensatory mitigation requirements for DA permits."

If a case is made that permittee-responsible mitigation is more ecologically appropriate than ILF or mitigation banking, then restoration in association with preservation is often preferred. However, good restoration sites can be hard to find in New England. Restoration, provided there have been no irreversible changes to the hydrology (for wetlands and streams) or water quality (eelgrass), has higher likelihood of success than the other compensatory mitigation methods, is less

likely to impact potentially ecologically important uplands than is creation, provides greater gains in aquatic resource functions compared to preservation, and provides greater gains in resource areas/linear feet than rehabilitation. In addition, restoration sites are usually appropriately situated within the landscape. As such, higher ratios are typically required for creation, rehabilitation, and preservation and different performance standards may apply. For example, where invasive species control is the rehabilitation project, the performance standard may allow less cover of invasive species present to meet the standards than for a general creation or restoration project.

For additional information on planning and implementing successful compensatory mitigation projects, see the National Research Council's "Operational Guidelines for Creating or Restoring Wetlands that are Ecologically Self-Sustaining" (2001). They may be found as Appendix B in the Corps' Regulatory Guidance Letter 02-02 "Guidance on Compensatory Mitigation Projects for Aquatic Resource Impacts under the Corps Regulatory Program Pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899."

2.c. Preservation as Mitigation

In order to meet the goal of no net loss of wetland functions, the Corps expects mitigation comprised solely of preservation to be acceptable in some, but not all circumstances. While preservation does not replace aquatic resource acres/linear feet or functions, it does reduce the threat of future impacts and may stem future aquatic resource degradation. For this reason, appropriate preservation-only projects may be a suitable means of compensatory mitigation in situations where meaningful aquatic resource restoration, creation, and/or rehabilitation opportunities have been exhaustively explored and do not exist, or are not practicable or ecologically desirable. When looking for mitigation opportunities, the geographic area of consideration is expected to be broad.

In its discussion of preservation, the Mitigation Rule states (at 33 CFR 332.3(h)) that:

> (1) Preservation may be used to provide compensatory mitigation for activities authorized by DA [Department of Army] permits when all the following criteria are met:
>
> (i) The resources to be preserved provide important physical, chemical, or biological functions for the watershed;
>
> (ii) The resources to be preserved contribute significantly to the ecological sustainability of the watershed. In determining the contribution of those resources to the ecological sustainability of the watershed, the district engineer must use appropriate quantitative assessment tools, where available;
>
> (iii) Preservation is determined by the district engineer to be appropriate and practicable;

(iv) The resources are under threat of destruction or adverse modifications; and

(v) The preserved site will be permanently protected through an appropriate real estate or other legal instrument (e.g., easement, title transfer to state resource agency or land trust).

(2) Where preservation is used to provide compensatory mitigation, to the extent appropriate and practicable the preservation shall be done in conjunction with aquatic resource restoration, establishment, and/or enhancement activities. This requirement may be waived by the district engineer where preservation has been identified as a high priority using a watershed approach described in paragraph (c) of this section, but compensation ratios shall be higher.

Following this guidance, suitable preservation as compensatory mitigation should make sense in the watershed context, provide protection of important aquatic resources, and be sustainable in the long-term (e.g., be near other protected resources to provide appropriate ecological continuities). Due to laws covering aquatic resources in all of the New England states that reduce development pressure on aquatic resources, New England District encourages a combination of upland and aquatic resource preservation that protects aquatic functions over aquatic resources-only preservation.

Preservation may also be used for other elements of mitigation than compensation. Wetlands within subdivisions, golf courses, etc. should generally be protected along with adequate buffers. This is part of the avoidance and minimization steps of mitigation, not part of compensation.

Permit applicants or mitigation bank/ILF sponsors with proposed preservation parcels for compensatory mitigation should provide evidence that the title is clear and does not have encumbrances that are problematic (as determined by the Corps). In addition, all preservation projects should include in their mitigation plans a long-term management plan, to be approved by the Corps, with adequate funding to ensure appropriate stewardship in perpetuity.

2.d. Effective Replacement of Functions

Applicants should expect that an acreage replacement of greater than 1:1 will be deemed appropriate for permanent losses of aquatic resources. The replacement ratio determined by the Corps will be based on several factors, including: the aquatic resource functions that are impacted, the difficulty of restoring or establishing the desired aquatic resource type and functions, the temporal loss of functions, the likelihood of success, and a "safety factor." The baseline included in the New England District ratios (see I.2.g. below) addresses the expected reduction in specific functions (fish and/or wildlife habitat, water quality functions performed by soils, etc.) of created or restored aquatic resources in comparison with naturally occurring aquatic resources. It also includes a safety factor to allow for an adequate

margin of safety in the case of project failure. Our experience shows that some portions of most mitigation sites fail to establish the required aquatic resource area and/or functions. In the case of wetlands, sites may fail to develop the appropriate hydrology, which diminishes these sites' contribution to the no net loss goal. In the case of streams, constructed in-stream structures or channel and bank grading may fail or not perform as expected.

2.e. Mitigation Site Selection

The Mitigation Rule includes the following requirements for site selection (33 CFR 332.3(d)):

> (1) The compensatory mitigation project site must be ecologically suitable for providing the desired aquatic resource functions. In determining the ecological suitability of the compensatory mitigation project site, the district engineer must consider, to the extent practicable, the following factors:
>
> (i) Hydrological conditions, soil characteristics, and other physical and chemical characteristics;
>
> (ii) Watershed-scale features, such as aquatic habitat diversity, habitat connectivity, and other landscape scale functions;
>
> (iii) The size and location of the compensatory mitigation site relative to hydrologic sources (including the availability of water rights) and other ecological features;
>
> (iv) Compatibility with adjacent land uses and watershed management plans;
>
> (v) Reasonably foreseeable effects the compensatory mitigation project will have on ecologically important aquatic or terrestrial resources (e.g., shallow sub-tidal habitat, mature forests), cultural sites, or habitat for federally- or state-listed threatened and endangered species; and
>
> (vi) Other relevant factors including, but not limited to, development trends, anticipated land use changes, habitat status and trends, the relative locations of the impact and mitigation sites in the stream network, local or regional goals for the restoration or protection of particular habitat types or functions (e.g., re-establishment of habitat corridors or habitat for species of concern), water quality goals, floodplain management goals, and the relative potential for chemical contamination of the aquatic resources.

Whenever possible, mitigation sites should be located in a setting of comparable landscape position and hydrogeomorphic (HGM) class (riverine, depressional, lacustrine fringe, tidal fringe, mineral flats, organic flats, and slopes) and subclass as the impacted aquatic resource. The HGM classification relates to the landscape position and water source of the aquatic resource. In the case of streams, the stream type (transport or response) should be comparable. These features affect the

functions that the aquatic resource performs and should therefore be used as a guide for developing compensatory aquatic resources intended to duplicate the impacted functions. Slope discharge wetlands will function very differently than precipitation-driven depressional wetlands just as transport stream reaches will perform very differently from response stream reaches. Functions relating to groundwater recharge/discharge, water quantity attenuation, nutrient/sediment/ toxicant retention, and even fish and wildlife habitat are affected by the location in the landscape of the aquatic resource and the way the water moves into and out of the site.

Compensatory mitigation projects should seek to duplicate the features of reference aquatic resources or enhance connectivity with adjacent natural upland and aquatic resource landscape elements. Mitigation project sites should be selected based on their ability to be, and continue to be, resistant to disturbance from the surrounding landscape, by locating them adjacent to refuges, buffers, green spaces, and other preserved natural elements of the landscape. In general, aquatic resource mitigation projects should be designed to be self-sustaining, natural systems within the landscape and climate in which they are located, with little or no ongoing maintenance and/or hydrologic manipulation.

Long-term sustainability is a key feature of successful mitigation. Wherever possible, sites should be selected in areas where aquatic resources previously existed and/or where nearby aquatic resources currently exist. Restoration is generally more feasible and sustainable than creation of aquatic resources. However, in some cases, long-term sustainability of restored functions is not feasible due to degradation of the overall landscape. In such cases, out-of-kind mitigation may be appropriate to achieve long-term sustainability and, in such cases, should be based on consideration of watershed needs. Applicants should consider both current and expected future hydrology (including effects of any proposed manipulations and sea level rise), sediment transport, locations of water resources, and overall watershed functional goals before choosing a mitigation site. This is extremely critical in watersheds that are rapidly urbanizing or are in or adjacent to tidal zones. Changing infiltration rates can modify runoff profiles substantially, with associated changes in sediment transport, flooding frequency, and water quality. More importantly, applicants must plan for long-term survival by placing mitigation in areas that will remain as open space and not be severely impacted by clearly predictable development. Consideration of the landscape perspective requires evaluation of buffers and connectivity (both hydrologic- and habitat-related). Buffers are particularly important to insure that adverse effects of changes in land use are ameliorated, especially in watersheds that have been, or are in the process of being, heavily developed.

Degraded habitats are favored compensation locations; however, the potential for invasive species establishment should be taken into consideration when evaluating the appropriateness of these sites for mitigation. Habitat degradation varies across a continuum and so must flexibility in designing mitigation projects at such sites.

Creation and restoration sites should not result in the degradation or destruction of valuable uplands. For example, mature forested uplands and other non-degraded uplands are generally inappropriate for use as wetland creation sites. Likewise, creation and restoration of eelgrass habitats should avoid bottom habitats that already have valuable aquatic functions. In addition, the presence of nearby eelgrass habitat may argue against creating new habitat in that location as the expectation is that the eelgrass would spread to the adjacent unvegetated bottom if it were suitable habitat.

Surrounding land use/plans, including probable future land use - Consider current and future landscape features or public issues that may control or influence design. Consider the effect of the mitigation site on roads, airports, rights-of-way, site access, and utilities, as well as on drainage, including the potential for flooding both upstream and downstream of the site. Also consider the potential effect of adjoining land uses, including agriculture, residential, and industrial uses, roads, rights-of-way, utilities, and drainage easements on the mitigation site and its success and functions. Urbanization of the watershed may increase runoff and nutrient inputs from stormwater and septic systems. Both sources can degrade water clarity and quality, impacting submerged aquatic vegetation habitats. Identify the location and approximate extent of any existing, adjacent special aquatic sites. Consider whether there are riparian areas along waterways where water quality may be enhanced, or whether there are adjacent woodlands that may buffer aquatic resources from less compatible land uses.

Stormwater Basins - Typically, detention/retention basins are not appropriate for use as compensatory mitigation. Their construction results from requirements of the constructed project to mitigate stormwater concerns for the project itself, not address the lost functions of the impacted wetlands. In addition, they often require frequent maintenance to retain functionality, decreasing their ability to develop a full suite of wetland functions that can be self-sustaining in the long term. However, detention/retention basins can serve to minimize the adverse effects of a project on nearby wetlands and waters, provided that the stormwater management system will be maintained for the life of the project.

Other Site Selection Considerations

There are a variety of other considerations which should be taken into account in mitigation site selection. These include watershed-scale features, size and location of sites relative to water sources, compatibility with adjacent land uses and watershed plans, foreseeable effects of mitigation on ecologically important resources, and development trends and anticipated land use changes.

2.f. Difficult to Replace Aquatic Resources

Some types of aquatic resources are "difficult-to-replace." These include, but are not limited to: bogs, fens, springs, streams, vernal pools, and Atlantic white cedar swamps. Mitigating impacts to such resources require very careful analysis and study to determine if in-kind creation is likely to succeed or if out-of-kind compensation may be more appropriate for that project.

2.g. Amount of Compensatory Mitigation

Like many Corps districts around the country, New England District has developed standard compensatory mitigation ratios to serve as a starting point for developing adequate compensatory mitigation. These ratios provide guidance for most compensatory aquatic resource mitigation required by New England District. They are particularly designed for direct permanent impacts, with additional mitigation required to address temporary fill impacts and secondary impacts (effects on an aquatic ecosystem that are associated with a discharge of dredged or fill materials, but do not result from the actual placement of the dredged or fill material, e.g., fragmenting wildlife habitat, alteration of hydrology, removal of vegetation, degraded water quality, increased turbidity, increased biological stressors, etc.) on another scale. The ratios are based on:

- Complexity of system impacted,
- Likelihood of mitigation success,
- Degree to which acres/linear feet and functions are replaced, and
- Temporal losses for certain functions (e.g., water quality renovation, wildlife habitat).

These guidelines represent guidance for the New England District. As such, they are not intended to represent a binding regulation, and are not intended to be enforceable against the Army Corps of Engineers by third parties. While these ratios are the starting point for developing appropriate compensatory mitigation, there continues to be flexibility on a project-by-project basis in order to achieve the most appropriate mitigation for a specific project and, based on the facts of a particular situation, permit decisions may result in different requirements than the ratios set forth in this document. The functions and levels of functions impacted are important in determining adequate and appropriate compensation. Some of the factors to be considered in developing project-specific compensation include:

- The functions provided by the proposed impact site (including the level of those functions).
- The functions provided by the proposed compensatory mitigation project (including the estimated level of those functions upon completion of

construction and completion of the monitoring period – as opposed to the level of functions at the site's "maturity" which may be decades in the future).
- Temporal losses of aquatic resource functions.
- The method of compensatory mitigation (e.g., restoration, creation).
- The likelihood that the compensatory mitigation project will attain the performance goals.
- Any risks and/or uncertainties associated with the proposed compensatory mitigation project.
- The distance between the impact site and the compensatory mitigation project site, particularly if they are in different HUC-8 watersheds or ecoregions.
- The relationship between the impacted watershed and the watershed served by the mitigation project.
- The needs of the watershed and identified restoration and protection priorities identified in other appropriate watershed plans.

This flexibility may lead to a determination by the Corps of an amount and type of compensatory mitigation that differs from that included here. Project-specific ratios may be lower than depicted here, or they may be higher so that unavoidable impacts to high quality aquatic resources may be adequately mitigated and/or secondary impacts may be addressed. Proven mitigation methods and confidence that the proposed plan substantially reduces the risks inherent in aquatic resource construction may also be considered in determining the appropriate ratios for a specific project. The New England District will also work closely with state regulatory agencies to achieve as much consistency as possible, given differing state and federal legislative and program requirements; however, these guidelines are designed to meet the federal compensation requirements and may not meet state requirements.

Recommended Ratios for Direct Permanent Impacts (see resource-specific mitigation ratios in the aquatic resource modules in Appendices D-H)

It is extremely important to mitigate for affected functions, generally by replacing the same type of system impacted. This will vary with watershed and landscape considerations; the mitigation should be functionally and geographically appropriate. The ratios are based on the type of aquatic resource impacted, not the type of aquatic resource proposed for compensation. The ratios were developed with the presumption of in-kind compensation (which will not always be appropriate) and ranges are meant to reflect the quality of aquatic resource at the impact site and the level of functions impacted. If an appropriate watershed plan is available and that plan identifies a specific type or types of aquatic resources that are priorities for restoration or protection, such plans can provide a rationale for out-of–kind compensation. In cases where out-of-kind compensation is performed, project-specific ratios may be applied.

Several specific types of systems (e.g., riffle and pool complexes) are not specified here as they will generally require resource-specific and/or project-specific compensation determinations.

The proximity of impaired waters will be considered. Greater mitigation ratios may be needed for projects near impaired waters to protect water quality. Impaired waters are those waters which do not meet state water quality standards (even after point sources of pollution have installed the minimum required levels of pollution control technology). It is the responsibility of the applicant to identify whether a project is in the vicinity of a designated impaired water by referring to a state's or tribe's list and/or maps of impaired waters as designated pursuant to Section 303(d) of the Clean Water Act.

In many cases, degraded water quality will be a major determining factor in whether a mitigation project achieves success. When an applicant proposes a mitigation project in designated impaired waters, the expected lower success rate will be considered. Hence, locating something such as eelgrass mitigation in impaired waters should be contemplated only after all other alternative sites and approaches (e.g., water quality remediation) have been ruled out.

Please see the recommended resource-specific mitigation ratios and calculations in the aquatic resource modules in Appendices D-H. Sample hypothetical calculations of appropriate mitigation using the ratio guidance in Tables 1-6 is posted on the New England District website under "Mitigation."

Recommended Mitigation for Temporary and/or Secondary Impacts to Wetlands (see resource-specific mitigation ratios in the aquatic resource modules in Appendices D-H)

Impacts to aquatic resource functions resulting from temporary placement of fill or as a secondary impact of the permanent or temporary placement of fill can be substantial. In many cases, it will be necessary to compensate for such temporary and secondary impacts to prevent a net loss in aquatic resource functions. Corps regulations published in the March 19, 2012, Federal Register state in C.23.(h):

> "Where certain functions and services of waters of the United States are permanently adversely affected, such as the conversion of a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse effects of the project to the minimal level."

In temporary fill situations, although the fill is not permanent, impacts may remain after the fill is removed. For example, there may be shearing caused by pressure on organic or fine-grained soils, which presses the soil outward, causing upheaval. There may also be compaction which can result in changes to movement of subsurface and/or surface water and conversion of wetland type within and/or

adjacent to the temporary fill area. There may be conversion to upland due to upheaval or incomplete reestablishment of grade. In addition, temporary impacts may lead to a temporal loss of aquatic resource acres/linear feet and/or functions that should be addressed through compensatory mitigation. Site conditions should be evaluated to determine if any of these long-term effects are likely to occur.

Suggestions for mitigation for temporary (in addition to restoration in place) and secondary impacts are expressed as percentages or ranges of percentages of the mitigation recommended for direct, permanent impacts. There are several factors to consider in determining whether compensatory mitigation is needed for temporary and secondary impacts and in applying the ranges to determine the appropriate level of mitigation for a specific project and type of system, as described below.

- Removal of forested wetland vegetation: density and diversity of original woody vegetation, soil type (organic or mineral), effects of substrate compression, whether work is performed during dry or frozen conditions only, original aerial cover, presence/absence of exemplary vegetative community, threatened and endangered species habitat, length of time fill will be in place, likelihood of shearing causing upheaval, etc. Habitat is presumed to be the principal function affected but there may also be changes in soil temperature, creation of a window of opportunity for invasion by exotic species, temporary reduction in biomass and carbon sequestration, and changes to hydrology as a result of reductions in evapotranspiration. Compensatory mitigation addresses temporal impacts during the time temporary fill is in place and during forest re-establishment.
- Temporary and secondary impacts to scrub-shrub and emergent wetlands: soil type, effects of substrate compression, whether work is performed during dry or frozen conditions only, presence/absence of exemplary vegetative community, threatened and endangered species habitat, length of time fill will be in place, likelihood of shearing causing upheaval, etc.
- Vernal pool envelope and critical terrestrial habitat impacts: original aerial cover, relationship to other vernal pools, etc.
- Stream riparian cover impacts: distance of impact from stream, width of impact, original aerial cover, etc. Secondary impacts may include water temperature, water quality, fish and wildlife habitat (including travel corridors), production export, and streambank stabilization.

2.h. Documentation of Long-Term Protection

Long-term protection is an important element of every compensatory mitigation project). The created, restored, and rehabilitated sites should be preserved in perpetuity, along with an appropriate buffer, to ensure the long term viability of these compensatory mitigation sites. There are numerous mechanisms that are deemed appropriate for providing long-term protection for mitigation sites. These include fee transfer to another entity such as a non-profit conservation organization or public agency with a conservation mandate, an easement held by a non-profit

conservation organization or public agency with a conservation mandate, deed restriction, or restrictive covenant. The form should be specified in the text and a copy of the draft document(s) included. Fee transfer with third party enforced conservation covenants or conservation easements is preferred. Deed restrictions are discouraged as they are difficult to enforce and may be easily changed.

2.i. Buffers

In most cases, a protected (preserved) buffer will be required around creation, restoration, and rehabilitation sites, including stream mitigation, as this is of benefit on a local and watershed scale throughout New England. The extent of the buffer will depend upon the landscape position of the site(s) and current and potential surrounding land uses but it will be rare that a buffer less than 100 feet in width will be adequate. Buffers greater than 100 feet in width are generally encouraged. Usually buffers will consist of uplands but wetlands also may serve that function in some situations. Vernal pools require a substantial area of adjacent forested terrestrial habitat (both upland and wetland) in order to adequately support vernal pool dependent wildlife. The buffer requirements for projects involving vernal pools would likely be greater than 100 feet in width and vary spatially relative to the proximity to critical adult habitat.

Compensatory mitigation that involves restoration, creation, and rehabilitation benefits greatly from the presence of upland buffer to prevent site degradation resulting from nearby activities and enhances long-term sustainability. This buffer area would count toward upland preservation mitigation credit. A preserved buffer of a minimum of 100' from each bank is recommended for stream restoration and enhancement projects, but may be smaller based on landscape features. Eelgrass also benefits from the protection of headwater streams, nearby lands, and adjacent bottom habitat but the potential for compensation credit will be dependent upon site and project-specific circumstances.

2.j. Relationship to Other Federal, Tribal, State, and Local Programs

Occasionally there are conflicts between requirements of the Corps and those of state and/or local agencies, due to the differing regulations that each operate under. The amount, type, and location of compensatory mitigation required by the Corps can differ substantially from that required by other federal, tribal, state, and local programs. Also note that, when mitigation banks and/or In-lieu Fee programs are available, Corps regulations state a general preference for their use for mitigation unless permittee-responsible mitigation is determined to be more appropriate.

2.k. Party(ies) Responsible for Compensatory Mitigation

The Mitigation Rule requires that the entities responsible for the implementation, performance, and long-term management of the mitigation project be listed.

2.l. Timing

Whenever feasible, mitigation construction should be in advance of or concurrent with the authorized impacts. The timing of the proposed compensatory mitigation may affect the amount of mitigation required.

2.m. Financial Assurances

Financial assurances are required to ensure a high level of confidence that the project will be completed and achieve the goals intended. Depending on the timing, certainty (or lack of same), difficulty of the compensation, and the track record of the applicant, financial assurances, particularly performance bonds, letters of credits, or escrow accounts, may be required for all aspects of the mitigation (acquisition, construction, and monitoring—including remediation).

Government entities which are unable to provide performance bonds or similar assurances, should provide a formal, documented commitment that covers all aspects of the mitigation, including project replacement, monitoring, remedial activities, and long-term stewardship.

Financial assurances for construction and monitoring may be phased out, with written approval by the Corps, as various stages of the project are deemed complete and successful according to specified conditions linked to performance standards, adaptive management, or compliance with special conditions.

Long-term funding must be provided to ensure that sites will have a source of funding for long-term management and, where appropriate, defence and management of the long-term site protection instruments. The amount of long-term funding that is set aside should reflect the management needs outlined in the long-term management plan, risks associated with the long-term site protection instrument (e.g., easement violations), and should address inflationary adjustments and other contingencies, as appropriate. Appropriate long-term financing mechanisms may include non-wasting endowments, trusts, contractual arrangements with future responsible parties, or other appropriate financial mechanisms.

I.3. Planning and Documentation – Mitigation Plan

The Mitigation Rule requires that the public notice for an individual permit contain a statement explaining how impacts associated with the proposed activity are proposed to be avoided, minimized, and compensated for. This would include the amount, type, and location of proposed compensatory mitigation, including if any is out-of-kind. If a mitigation bank credit or an In-lieu Fee is proposed, only documentation of the availability of credits is required.

The Mitigation Rule requires that the following items be incorporated into final mitigation plans:

- Objectives
- Site Selection
- Site protection instrument
- Baseline information
- Determination of credits (how the project will provide the required compensation for unavoidable impacts)
- Mitigation work plan
- Maintenance plan
- Performance standards
- Monitoring requirements
- Long-term management plan
- Adaptive management plan
- Financial assurances

See Appendices C-H for specific mitigation plan data needs.

3.a. Data Presentation

The use of charts, tables, and plan overlays to present data for impact and mitigation areas is encouraged. They are often the most concise method of conveying information and make comparison easier. Submissions in portable document format (pdf) and GIS polygon files (shapefile, geodatabase, or other GIS format) are strongly encouraged.

3.b. Hydrological Considerations

Hydrology is the driving force of aquatic resources, including wetlands, which are particularly sensitive to hydrologic variability. The variation in functions between wetland types is in large part due to fluctuations in water flow, depth, duration, and/or frequency. The emphasis for mitigation wetlands should be on establishing naturally variable hydrology. Hydrology within the mitigation site should be comparable to a reference aquatic resource within the same landscape setting (HGM

type). Target hydrology should be based on this reference condition for the proposed wetland type and not simply based on a bare minimum for meeting the hydrology technical standard (US Army Corps of Engineers, 2005) as this will usually not result in functional replacement. Reestablishment of natural hydrology is encouraged; active engineered devices are discouraged. When natural hydrology is not feasible, consider passive structures to sustain the desired hydroperiod over the long term. Avoid designing a system that depends on water-control structures or other infrastructure that must be maintained in perpetuity in order to provide the necessary hydrology. In situations where direct or in-kind replacement is desired, mitigation sites should have the same basic hydrological attributes as the impacted site.

Essential hydrology may not be immediately available. If this is the case, it is appropriate to factor the availability of that water in the timing of any plantings.

Monitoring Wells - Note that monitoring wells may not be necessary if other data are adequate. If you are considering monitoring wells, you should discuss this issue with Corps staff to clarify the need and nature of the data prior to installation.

Note that there is an important difference between monitoring wells and piezometers, both of which provide useful information. Since accurate placement and installation of monitoring wells and/or piezometers affects the accuracy and usefulness of the data, details on the uses for and installation of both of these types of wells are available in three documents prepared by the Engineers Research and Development Center's (ERDC) Environmental Lab, previously known as the Waterways Experiment Station (WES):

- "Installing Monitoring Wells/Piezometers in Wetlands", ERDC TN-WRAP-00-02
- "Technical Standard for Water-Table Monitoring of Potential Wetland Sites", ERDC TN-WRAP-05-02.
- "Water Table Monitoring Project Design," ERDC TN-WRAP-06-2

If monitoring wells are used and the site is adjacent to a wetland system, installation of at least one well in the adjacent system may provide useful information on the relationship of the water table in the wetland to the one in the proposed mitigation site.

Precipitation data is available on the Internet. Sites include the National Weather Service under the appropriate Eastern Region Weather Forecast Office and the Northeast Regional Climate Center.

3.c. Planting (for Wetlands, Vernal Pools, and Stream Riparian Areas)

Planting and/or seeding are generally appropriate for a mitigation site, as determined through consultation with the Corps. When planting is proposed as part of the plan, the guidelines noted below should be followed.

Irrigation - Note that irrigation is solely a temporary measure to enhance the success of vegetation establishment, not to provide hydrology. The use of irrigation for woody plantings should be considered for the first one or two growing periods after planting due to the unpredictability of short-term local hydrologic conditions and the need for additional care to establish new plantings. Equipment (e.g., pipes, pumps, sprinklers) must be removed and irrigation discontinued no later than the end of the second growing period unless the Corps concurs with extended irrigation. In this situation, the monitoring period shall be extended an equivalent time period.

Two methods have been used successfully: water trucks and installation of irrigation systems. The former is limited by accessibility for the truck(s), a likely problem on large sites. The latter tends to be less expensive and may be more effective for large projects.

Use of Mulch - The use of mulch around woody plantings is strongly encouraged, and may be required, to reduce the need for irrigation and to reduce competition by herbaceous vegetation in the immediate vicinity of each plant for a couple of years. There are at least two methods available: biodegradable plastic or fiber (which should be stapled or staked to the ground) or organic mulch. Note that organic mulch is not considered to be part of the organic content of the topsoil and it should not be used in locations that will be inundated as it may float away. Suggested specifications for organic mulching are as follows:

- Mulch balled and burlaped or container-grown trees and shrubs in a 3' diameter circle approximately 2" deep.

- Mulch bare-root woody planting in an 18" diameter circle approximately 2" deep.

Planting Density - Woody planting densities may require adjustment depending upon the goals of the mitigation plan and the 'reference wetland' used to develop the habitat goals. For example, if the primary goal for a particular creation site is flood storage and there is minimal need for wildlife habitat but there is interest in developing a woody component in the flood storage area, the density may be reduced. Also, if the wetland type desired is a dense thicket, the density may need to be increased.

Plant Species - Native planting stock scavenged from the immediate vicinity of the project is ideal as it minimizes the threat to native diversity. Salvaging native plants

from wetlands and uplands cleared by the project is strongly encouraged. Transplanting entire blocks of vegetation with several inches of the original wetland soil substrate from the impact areas has been found effective in establishing mitigation wetlands. However, beware of the potential for transplanting invasive species.

Although the use of non-native species is typically discouraged, there are situations where such use may be appropriate such as using *Secale cereale* (Annual Rye) to quickly stabilize a site. Any such species should be noted and the reason for their use explained.

No cultivars shall be used. Beware of stock identified as a native species which is actually a cultivar or non-native species (e.g., there have been numerous instances around New England of *Alnus incana* or *Alnus rugosa* labels appearing on seedlings of non-native *Alnus glutinosa*).

Non-native or otherwise unacceptable species are listed in Appendix I[1] and are not to be included as seed or planting stock in the overall project. Many of these species may not need to be actively removed from the site. Exceptions are included below in the discussion of invasive species. More may be added by the Corps on a case-by-case basis.

The Emerald Ash-Borer, an insect species that is damaging to ashes, especially green ash (*Fraxinus pennsylvanicus*), is moving into New England. Therefore, consideration of this should be made before incorporating ash (*Fraxinus* spp.) into planting plans. The Asian Long-horned Beetle and other invertebrate pests may be problems in certain areas and/or on specific species.

Herbivory - Herbivory by white tailed deer, rodents (e.g., meadow voles, beaver), and rabbits can adversely impact forest stand development. Rodents frequently girdle seedlings, increasing mortality of plantings. Herbivory by Canada geese has impaired establishment of both herbaceous and woody communities in agricultural and old field settings, as well as in salt marshes. Mute swans (*Cygnus alor*) cause significant damage to submerged aquatic beds throughout Long Island Sound. Herbivory from invasive species like the green crab (*Carcinus maenas*) has been shown to extirpate naturally occurring or created eelgrass beds (Williams, 2007). Measures that have been used to address herbivory, with mixed success, include the use of tree tubes, fencing, nurse crops, trapping, hunting, chemical deterrents, attracting predators, removing cover for herbivores, planting browse-tolerant coppicing shrubs (e.g., willows and alders), etc.

[1] This list is a compilation of state lists from New England and additional species recommended by regional botanical experts.

3.d. Invasive Species

There is growing recognition of the negative impact that invasive species have on the environment, economy, and health of the United States[2]. Projects should avoid introducing or increasing the risk of invasion by unwanted plants (such as those species listed below) or animals (such as zebra mussels and Asian long-horned beetles). Soils disturbed by projects are very susceptible to invasion by undesirable plant species. Be particularly alert to the risk of invasion on exposed mineral soils; these may result from excavation or filling. In addition, construction equipment can be a source of contamination and should be thoroughly cleaned prior to arrival on the project site (the US Bureau of Reclamation produced a September 2009 document on equipment inspection and cleaning). Invasive species often get a foothold along project drainage features where the dynamics of erosion and accretion prevail. Along salt marshes, be especially alert to the project's influence on freshwater runoff. Frequently, *Phragmites australis* invasion is an unanticipated consequence of freshwater intrusion into the salt marsh. Useful information may be found in the Invasive Plants Atlas of New England. It should also be noted that, although relatively rare, there are populations of native *Phragmites australis* (*P.a.* ssp. *americanus*) throughout New England and these plants should be conserved, rather than controlled.

In the case of eelgrass habitat, non-native species can negatively impact the establishment and persistence of mitigation beds through herbivory, encrusting growth on shoots, physical disturbance, etc. Common invasive species in these habitats include green crabs, mute swans, colonial tunicates, and bryozoans (Williams, 2007).

Because of the pervasiveness of invasive species in New England and the damage they do to aquatic resources, the Mitigation Plan must include an Invasive Species Control Plan (ISCP). The ISCP should:

- Discuss the risk of colonization by invasive species (plant and/or animal). The discussion of risk should include an assessment of the potential for invasion of the wetland by the species listed below or other identified problematic species specific to this project or site. The assessment of risk should consider the local and regional backdrop of invasive species, the potential mechanisms for the spread of invasives (e.g., contaminated equipment and machinery), the potential virulence and responsiveness to control of the species.

- Identify regulatory and ecological constraints that influence the design of any plan to control invasive plants and animals by biological, mechanical, or chemical measures. For example, if a state requires a permit for use of herbicide, this will be a factor in developing a plan to control an invasive plant species. If there are no constraints, this should be stated.

[2] U.S. Army Corps of Engineers Invasive Species Policy (2 June 2009)

- Describe the strategies to prevent the introduction of invasives and to recognize and eradicate or control the degradation of the mitigation site by invasive or non-native plant species. The invasion by the following invasive species, and any other species identified as a problem at the project or mitigation sites, should be controlled. See the New England District's website for some links providing information on controlling these species. The ISCP should address a full range of practicable measures to minimize threats to wetlands as well as all associated buffers or other habitats that are factored in project impact mitigation. The ISCP should consider traditional control methods including: mechanical (pulling, mowing, or excavating on-site), chemical (application of herbicides), and biological (planting fast-growing trees and shrubs for shading or releasing herbivorous insects). Please review the "Guidelines for Disposal of Terrestrial Invasive Plants" published by the University of Connecticut prior to disposal of any invasive species material.

    - Common reed (*Phragmites australis*)
    - Purple loosestrife (*Lythrum salicaria*)
    - Glossy and Common buckthorns (*Frangula alnus*, *Rhamnus cathartica*)
    - Russian and Autumn olives (*Elaeagnus angustifolia* and *E. umbellata*)
    - Multiflora rose (*Rosa multiflora*)
    - Reed canary-grass (*Phalaris arundinacea*)
    - Japanese knotweed (*Fallopia japonica*)
    - other species identified as a current or likely problem at the site

In addition to these species, none of the species listed in the "Invasive and Other Unacceptable Plant Species" (Appendix I) should be planted anywhere on the project site. For more information on invasive species and ISCPs, please see additional information and guidance on New England District's Regulatory webpage.

3.e. Erosion Controls

Cordoning off of an entire site with erosion controls is discouraged as it impedes animal movement. If circling of an entire site is needed, either gaps or overlaps with intervening space should be provided. Silt fences must be removed or cut to ground level when no longer needed. Nylon netting or non-biodegradable erosion control mats and/or netting must not be used in the mitigation area.

3.f. Mitigation Plan Guidance and Checklists

The majority of compensatory mitigation in New England is for impacts to non-tidal wetlands and much of this guidance reflects that. However, there are a variety of other types of aquatic resources which are impacted and for which compensatory mitigation is required. Some of the more common of these other aquatic resources include vernal pools, submerged aquatic vegetation (SAV), and streams. Special

concerns and guidelines noted for developing compensatory mitigation for each are included as a resource module in their respective appendix. A complete mitigation plan should contain all of the pertinent information from the Overall Mitigation Plan Checklist, as well as all of the pertinent information from all of the specific resource modules that apply to the project.

Guidelines for specific resource types and directions for completing mitigation plan (using checklist) may be found in the following appendices:

Appendix C - Basic Mitigation Plan
Appendix D - Wetlands Module
Appendix E - Vernal Pool Module
Appendix F - Submerged Aquatic Vegetation Module
Appendix G - Stream Module
Appendix H – Other Aquatic Resources Module

I.4. Ecological Performance Standards

In consultation with the Corps, the applicant will develop clear and concise ecological performance standards to be used to assess whether the mitigation project is achieving its objectives. The standards must be based on attributes that are objective and verifiable.

Performance standards may be based on variables or measures of functional capacity; measurements of hydrology, vegetative diversity or physical characteristic (e.g., height, aerial cover, stem counts per specified area); or other aquatic resource characteristics. Another option is to provide comparisons to reference aquatic resources of similar type and landscape position. When practicable, the performance standards should take into account the expected stages of aquatic resource development. Below are some examples of ecological performance standards. **These are ONLY EXAMPLES and specific performance standards should be individually crafted for each compensatory mitigation project.**

Performance Standard EXAMPLES

1) The site has the necessary depth of hydrology, as demonstrated with well data collected at least weekly from March through June or other substantial evidence, to support the designed wetland type as compared to the reference wetland. Minimum of 90% of the site must meet desired hydrology levels. Areas that are too wet or too dry (i.e., seasonal high water tables are more than 3" above or below target levels) should be identified along with suggested corrective measures.

2) Target hydroperiod **[specify]** must be met, within two weeks at beginning and end of proposed wet season (as long as minimum hydrology technical standard is met).

3) The proposed vegetation diversity and/or density goals for woody plants from the plan are met.

Unless otherwise specified in the mitigation plans, this should be at least 500 trees and shrubs per acre, of which at least 350 per acre are trees for proposed forested cover types, that are healthy and vigorous and are at least 18" tall in 75% of each planned woody zone AND at least the following number of non-invasive species including planted and volunteer species. Volunteer species should support functions consistent with the design goals. To count a species, it should be well represented on the site (e.g., at least 50 individuals of that species per acre).

# species planted	minimum # species required (volunteer and planted)
2	2
3	3
4	3
5	4
6	4
7	5
8	5
9 or more	6

Vegetative zones consist of areas proposed for various types of wetlands (shrub swamp, forested swamp, etc.). The performance standards for density can be assessed using either total inventory or quadrat sampling methods, depending upon the size and complexity of the site.

4) a. Each mitigation site shall have at least 95% areal cover, excluding planned open water areas or planned bare soil areas (such as for turtle nesting), by native species (See Appendix I).

b. Planned emergent areas on each mitigation site shall have at least 80% cover by non-invasive hydrophytes.

c. Planned scrub-shrub and forested cover types shall have at least 60% cover by non-invasive hydrophytes, including at least 15% cover by woody species.

For the purpose of this performance standard, invasive species of hydrophytes are:

Cattails -- *Typha latifolia, Typha angustifolia, Typha x glauca*;
Common Reed -- *Phragmites australis*;
Purple Loosestrife -- *Lythrum salicaria*;
Reed Canary Grass -- *Phalaris arundinacea*; and
Glossy Buckthorn – *Frangula alnus* (= *Rhamnus frangula*).
[Other species determined case-by-case]

5) Until canopy coverage exceeds 30%, the average height of all woody stems of tree species including volunteers in each site, must increase by not less than an average of 10% per year by the fifth (Year 5 following construction) and tenth (Year 10 following construction) monitoring years.

6) The fifth year (Year 5) and tenth year (Year 10) monitoring reports shall contain documentation that all vegetation within the buffer areas is healthy and thriving and the average tree height of all established and surviving trees is at least 5 feet in height.

7) There is evidence of expected natural colonization as documented by the presence of at least 100 volunteer native trees and/or shrubs at least 3 feet in height per acre.

8) The following plants are being controlled at the site:

- Common reed (*Phragmites australis*)
- Purple loosestrife (*Lythrum salicaria*)
- Smooth and Common buckthorns (*Frangula alnus*, *Rhamnus cathartica*)
- Russian and Autumn olives (*Elaeagnus angustifolia* and *E. umbellata*)
- Multiflora rose (*Rosa multiflora*)
- Reed canary-grass (*Phalaris arundinacea*)
- Japanese knotweed (*Fallopia japonica*)
- [other species identified as a problem at the site]

For this standard, small patches must be eliminated during the entire monitoring period. Large patches must be aggressively treated and the treatment documented.

9) Site will have documented use by breeding populations of target species: **[insert species]**

10) Site will have documented use by target wildlife species: **[insert species]**

11) Site will have documented use by target macroinvertebrate species: **[insert species]**

12) Soil pH will be within target range of 6.2 – 6.8 for the site.

13) Soil has documented evidence of redoxymorphic features developing by the third year (Year 3) after construction.

14) All slopes, soils, substrates, and constructed features within and adjacent to the mitigation site(s) are stable.

15) No nylon netting or non-biodegradable netting may be used in the mitigation area.

16) Replace culvert which severs aquatic connectivity with one complying with the Stream Crossing Standards. New culvert complies with all applicable Stream Crossing Standards and maintains compliance through the monitoring period.

17) 25 foot wide riparian zones on both sides of **[specify]** stream/river for **[specify]** linear feet will have >60% aerial coverage by native species by the end of

the first growing season, >85% by the end of the second growing season, and - >95% by the end of the monitoring period.

18) Following dam removal, the footprint of the former dam is stable and continues to be stable through the monitoring period.

19) Formerly inundated areas are stable and have >95% aerial coverage by native vegetation.

20) Along the newly exposed stream channel, to ensure stream shading, banks have >95% aerial coverage with native woody species which are >5' in height.

I.5. Monitoring

A thorough monitoring plan is part of an adaptive management program that provides an early indication of potential problems and possible corrective actions and is used to determine if the project is meeting its performance standards. Monitoring of aquatic resource structure, processes, and function from the onset of restoration, creation, or rehabilitation can indicate potential problems. Process monitoring (e.g., water-level fluctuations, sediment accretion and erosion, plant flowering, and bird nesting) is particularly important because it may identify the source of a problem and remedial measures, as well as identifying functional development. Monitoring and control of non-native species must be a part of any effective adaptive management program. Assessment of aquatic resource performance must be integrated with adaptive management. Both require understanding the processes that drive the structure and characteristics of a developing the desired aquatic resource. Simply documenting the structure (i.e., vegetation, sediments, fauna, and nutrients) will not provide the knowledge and guidance required to make adaptive "corrections" when adverse conditions are discovered. Although the full maturation of a compensatory aquatic resource may take many years or even decades, process-based monitoring facilitates adaptive management to insure that the mitigation site is developing along an appropriate trajectory.

Once the final mitigation plan is incorporated into a permit or approved for use in third party mitigation, full implementation of the mitigation plan will be required, including remedial measures, during the first five or more growing periods (monitoring period) to ensure success. Typically, sites proposed to be emergent-only wetlands or submerged aquatic vegetation will be monitored for five years and sites proposed to be scrub-shrub and/or forested wetlands or are comprised of invasive species removal will be monitored for five to ten years (years 1, 2, 3, 5, 7, and 10 for the latter), as extended periods for monitoring will be appropriate in some cases. Monitoring for other aquatic resources, such as streams and vernal pools, will be geared toward the specific mitigation activities, but will be for a minimum of five years as required by the Mitigation Rule. While formal monitoring and submission of reports may not be required every year, some remediation activities (e.g., invasive species control efforts) should continue.

Permit non-compliance or failure to meet a credit release schedule can include:

- failure to implement the plan and/or remedial measures;
- failure to achieve the designed aquatic resource types (HGM and/or Cowardin for wetlands);
- failure to submit copies of financial assurances and/or site protection documents;
- failure to submit required monitoring reports, transmittal, and self-certification documents; and
- failure to submit the final assessment document.

If all or part of the mitigation is still deemed unsuccessful at the end of the monitoring period, or recognized during the monitoring period as unlikely to ever succeed, alternative mitigation must be developed to fully compensate for the authorized impacts.

Electronic submission of monitoring reports is strongly encouraged. Portable Document Format is preferred (e.g., Adobe PDF). When submitted in electronic format, there is no restriction for using standard paper sizes; however, monitoring report plans/data should be at the same scale as original permit mitigation drawings to allow for direct scale comparisons between mitigation plans and monitoring results. These monitoring reports should be concise and effectively provide the information necessary to assess the status of the compensatory mitigation project. Large, bulky reports containing general information are not necessary. The concise format for monitoring reports is included in Appendix C, Monitoring Report Requirements section. Additional monitoring guidance for specific habitat types is provided in several of the specific aquatic resource type modules in Appendices D-G.

I.6. Management

Site Protection

Appropriate real estate instruments providing long-term site protection include conservation easements (see I.2.h.) held by third parties, generally government agencies with a conservation mission, or non-profit conservation organizations. If the site is on federal or state government land, long-term protection may be provided through facility management plans, integrated natural resources management plans, or other appropriate mechanisms that provide a reasonable degree of durability. The third party shall have the right to enforce site protections.

The site protection document shall prohibit incompatible uses that would jeopardize the objectives of the mitigation project.

The document must also contain a provision requiring 60-day advance notification to the Corps before any action is taken to void or modify the instrument, including transfer of title to or establishment of other legal claims to the site(s).

Real estate instruments, management plans, or other long-term protection must be approved by the Corps in advance of, or concurrent with, the authorized impacts.

Adaptive Management

If the project cannot be constructed substantially in accordance with the approved mitigation plan, the permittee must notify the Corps and obtain written approval for changes.

Should a site not meet the ecological performance objectives of the project, the Corps will work with the permittee to determine appropriate measures to remedy the deficiencies. This may include site modifications, design changes, revisions to maintenance requirements, revised monitoring requirements, or use of a different site. Performance standards may be revised in accordance with adaptive management to account for measures taken to address deficiencies. They may also be revised to reflect changes in management strategies and objectives if the new standards provide ecological benefits that are comparable or superior to those originally approved. No other revisions to performance standards will be allowed except in the case of natural disasters.

Long-Term Management/Stewardship

Compensation sites are expected to mitigate impacts "in perpetuity." Since monitoring has a limited timeframe, a willing entity must be found to receive responsibility for the mitigation site(s) associated with a permit or instrument. That entity must have the resources and expertise in the long-term management and

stewardship of mitigation properties. The final mitigation plan must include a long-term management plan and should identify the party responsible for long-term management of the project. If, however, the mitigation provider is unable to designate the entity responsible for long-term management of the site at the time the mitigation plan (and its associated long-term management plan) are approved, future transfer of long-term management responsibility is acceptable after review and approval by the district engineer. In such cases, the mitigation provider is the default long-term manager until such time as the Corps approves transfer on long-term management responsibility to a third party.

The long-term management plan should include a description of possible long-term management needs (e.g., all terrain vehicle problems, littering, encroachment, boat damage), the annual cost estimates to address them, and a funding mechanism to meet those needs. Long-term funding must be provided to the long-term site manager to provide the resources needed to manage the site per the terms of the long-term management plan and enforce the site protections. The entity taking on the responsibility for the long-term management of the site may not necessarily be the same entity responsible for the real estate instrument (e.g., the easement holder).

As noted in the Preamble to the Mitigation Rule (p.19648-9 in the 4/10/08 Federal Register) in the discussion about 33 CFR 332.7(d) Long-term management:

> "Although compensatory mitigation projects should, to the extent it is practicable to do so, be self-sustaining, active long-term management and maintenance are often necessary for a compensatory mitigation project to fulfill its objectives. In such cases, provisions for long-term management need to be provided....
>
> "For permittee responsible mitigation, § 332.7(d)(4) has been added to require approval of any required long-term financing mechanisms before the permitted impacts occur.
>
> "...a long-term management plan should include a description of long-term management needs for the compensatory mitigation project and annual cost estimates for those needs, and identify the funding mechanism that will support the long-term management activities....
>
> "In this rule, financial assurances are used to provide a high level of confidence that compensatory mitigation projects will be completed, whereas long-term management measures are used to help ensure the long-term sustainability of compensatory mitigation projects. Funding for financial assurances is handled differently than funding for long-term management. The final rule clearly differentiates between financial assurances for construction and establishment of compensatory mitigation projects and funding mechanisms for long-term management of those projects. In general, funding

for long-term management should not be phased out over time, since those activities usually need to be conducted for substantial periods of time."

Some examples of work that may be needed to be conducted by the long-term steward as part of long-term management include: annual walk-through of the property to check on condition of signage, gates, and/or fences; evidence of ATV damage; presence of invasive species; unauthorized camping; evidence of dumping of trash, yard waste, etc.; and associated costs to address these (or other) issues.

To ensure the long-term management entity has adequate funding to do annual inspections, perform needed maintenance, and deal with problems, a financing mechanism (e.g., endowment, trust, or long-term financing plan for a public entity) should be provided. If an endowment is used, it should be sufficient that the needed stewardship activities can be covered by around 3% of the principal. This should generally allow the principal to continue to grow and cover inflation. The long-term steward/manager and the particulars of the endowment should be included in the mitigation plan and may also be included as a special permit condition or requirement for credit release.

II. ADDITIONAL GUIDANCE FOR CORPS PROJECT MANAGERS

Information on the Mitigation Rule and New England District Guidance should be provided to applicants as early as possible. The Mitigation Rule indicates that mitigation banks and in-lieu fee programs are preferable forms of compensatory mitigation over permittee-responsible mitigation. If permittee-responsible mitigation is to be used, there must be a justification for this in the permit support documents (e.g., EA/SOF).

Special Conditions

Four mitigation-related items must be in the permit special conditions for any permit requiring compensatory mitigation. They may be stated as four separate special conditions or combined into two or three conditions. The items include:

- identifying the specific mitigation proposed, including size(s) and type(s),
- referencing the mitigation plan,
- stating the ecologically-based performance standards, and
- stating the implications should the proposed mitigation fail

Examples:

- Mitigation shall consist of the restoration of 3.3 acres of button-bush and alder shrub swamp and preservation of the 3.3 acres plus 5.2 acres of wetland and upland adjacent to this restoration area located off Kensington Road in Concord, Massachusetts.

- This work shall be performed in accordance with the attached mitigation plan entitled, "Lower Bonneville Road Mitigation Plan" and dated "6 May 2009."

- The performance standards for this project are: a) documented presence of wetland hydrology appropriate for forested wetlands (in this specific case, soil saturation to the surface a minimum of four consecutive weeks during the growing period with no extended inundation of greater than two weeks, other than by greater than 10 year storms, between 30 April and 1 November), b) 75% cover by native hydrophytes, including 50% aerial cover by native wetland tree species, including red maple, (*Acer rubrum*), green ash (*Fraxinus pennsylvanicus*), and yellow birch (*Betula alleghaniensis*), at least 75% of which are over 2 meters tall, c) documented usage of the site by forested wetland-dwelling reptiles, d) control of non-native species with less than 10% total areal coverage by the end of the monitoring period, and e) all slopes stabilized and any silt fencing removed no later than the end of the third growing period.

- Mitigation shall consist of the restoration of 0.6 acre of non-degraded eelgrass habitat in Scituate, Massachusetts. The performance standards for density can be assessed using quadrat sampling methods. Final estimates of shoot density should be at least equal to that of the original impacted eelgrass bed which is 15 stems/sq. meter.

- Your responsibility to complete the required compensatory mitigation as set forth in Special Condition **[specify]** will not be considered fulfilled until you have demonstrated mitigation success and have received written verification from the U.S. Army Corps of Engineers. The term 'mitigation success' means success as defined in the mitigation plan this permit requires you to implement. Demonstration of success under this permit shall consist of meeting the performance standards listed in Special Condition **[specify]** plus the required mitigation monitoring, corrective measures, submittal of mitigation monitoring reports, and a final wetland assessment. Should the mitigation not meet the performance standards in Special Condition **[specify]** by the end of the monitoring period, you will be required to provide alternative compensation for the impacts authorized with this permit.

Financial Assurances

See 33 CFR 332.3(n) for requirements on financial assurances.

Original performance bonds, letters of credit, documentation of escrow accounts, insurance policies, etc. are now kept in the Resource Management (RM) safe in an envelope marked "REGULATORY" (see the RM Chief to access them). The Policy Analysis and Technical Support (PATS) Chief will also keep a file of copies and there should be a copy in the official project file.

Procedurally, if you have a project involving a financial assurance document, please provide the original (we will only get the original if we are the 'obligee') to the Chief, PATS Branch, to add it to the envelope in the RM safe. If you need to retrieve a document because the work is complete and the Corps has verified completion or satisfaction with the appropriate stage of work, contact the PATS chief.

These documents are very important and ORIGINALS SHOULD NEVER BE KEPT IN THE PERMIT FILE since eventually the file will be scanned and the original tossed.

APPENDIX A

GLOSSARY

These definitions are for use with this document. Somewhat different definitions may exist in other sources.

Active channel: The part of a non-tidal stream system within which natural processes maintain a linear depression for water flow, typically characterized by the presence of a bed and bank. The boundary of the active channel is the stream feature which most closely meets the criteria of the Ordinary High Water Mark." (Mersel et al., 2014) For tidal streams the boundary would be the high tide line.

Aggradation: A geologic process by which a stream bottom or floodplain is raised in elevation by the deposition of material (from Stream Visual Assessment Protocol; SVAP2).

Assessment Reach: For the purposes of the SVAP2, the length of the assessment reach is 12 times the active channel width or the total length of stream to be directly impacted or preserved/enhanced/restored, whichever is greater. The reach should be representative of the stream through the area.

Bankfull discharge: The stream discharge (flow rate, such as cubic feet per second) that forms and controls the shape and size of the active channel and creates the flood plain. This discharge generally occurs once every 1.5 years on average (from Stream Visual Assessment Protocol; SVAP2).

Bankfull stage: The stage at which water starts to flow over the floodplain; the elevation of the water surface at bankfull discharge (from Stream Visual Assessment Protocol; SVAP2).

Baseflow: The portion of stream flow that is derived from natural storage of precipitation that percolates to groundwater and moves slowly through substrate before reaching the channel. Baseflow sustains streamflow during periods of little or no precipitation and is the average stream discharge during low flow conditions (from Stream Visual Assessment Protocol; SVAP2).

Belt width (or meander belt width): Width of the corridor as defined by the lateral extent of the river meanders. It is governed by valley landforms, surficial geology, and the length and slope requirements of the river channel. (VT ANR River Corridor Protection Guide).

Buffer: An area along an aquatic resource that protects that resource from adverse impacts of nearby land uses. It may intercept pollution, provide a

wildlife corridor, supply shade to a waterway, stabilize sediments, reduce noise, provide habitat required by some aquatic species, etc. When located along a waterway it is termed a riparian buffer (see additional information in Appendix G: Stream Module).

Coastal ecologist: A biologist that studies the interaction of biological organisms with the coastal environment. The applicant should work with the Corps Project Manager to determine the appropriate expertise for the "coastal ecologist" needed to oversee a particular project. For example, they should have expertise and practical experience in subtidal habitats for projects involving subtidal habitats.

Compensatory mitigation: Action taken which provides some form of substitute aquatic resource for the impacted aquatic resource after all appropriate and practicable avoidance and minimization has been achieved. It may include created, restored, and/or rehabilitated wetlands, streams, mudflats, etc. and preserved wetlands, streams, and/or uplands provided by the permittee or a third party through a mitigation bank or in-lieu fee program.

Credit: A unit of measure (e.g., a functional or areal measure or other suitable metric) representing the accrual or attainment of aquatic functions at a compensatory mitigation site. The measure of aquatic functions is based on the resources restored, established, enhanced, or preserved. [33 CFR 332.2]

Cultivars: Non-native species or varieties which are developed for cultivation (e.g., agriculture, landscaping).

Debit: A unit of measure (e.g., a functional or areal measure or other suitable metric) representing the loss of aquatic functions at an impact or project site. The measure of aquatic functions is based on the resources impacted by the authorized activity. [33 CFR 332.2]

Degradation: A geologic process by which a stream bottom is lowered in elevation due to the net loss of substrate material. It is often referred to as downcutting (from Stream Visual Assessment Protocol; SVAP2).

Eelgrass rehabilitation: Restoring degraded FUNCTIONS of an existing eelgrass habitat. Degradation may result from infestation by herbivores, decreased water quality, or a change in substrate composition. Eelgrass habitat rehabilitation does **not** result in a gain in vegetated aquatic resource acreage.

Eelgrass habitat creation: The transformation of subtidal habitat to eelgrass beds at a site where it did not previously exist, so far as is known. It is sometimes referred to as "establishment." Eelgrass bed creation results in a gain in vegetated aquatic resource acreage.

Eelgrass restoration: Returning a former eelgrass habitat area, which had been altered or disturbed to the extent that it was no longer functioning as eelgrass habitat, to viable eelgrass habitat. It is sometimes referred to as "re-establishment." Eelgrass restoration results in a gain in vegetated aquatic resource acreage.

Embayment: Portions of marine/estuarine open water or marsh defined by natural topographical features such as points or islands, or by human structures such as dikes or channels. It is assumed that these semi-enclosed basins, due to their sheltered nature, provide a preferred growing environment for submerged aquatic vegetation (SAV), such as eelgrass.

Enhancement: The manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s), but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area. In this current sense, this is NOT the same as rehabilitation.

Ephemeral stream: A stream with a channel that is above the water table at all times and carries water only during and immediately after a rain event (from Stream Visual Assessment Protocol; SVAP2).

Epibiont (in the context of SAV): A plant or animal (e.g., macroalgae or colonial tunicates) that grows on the surface of another plant, usually for the purposes of physical support and exposure to currents that enhance nutrient exchange.

Establishment (creation): The manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area and functions. This is equivalent to the traditional use of the term "creation."

Exotic species: Used in this context, the same as non-native species - species not native to New England, and usually not native to North America.

Herbivore: Any animal that primarily feeds on living plants.

Hydrogeomorphic (HGM) Classification: A Hydrogeomorphic wetland classification system based on geomorphic position and hydrologic characteristics used to classify wetlands into seven different wetland classes, as defined by Brinson (1993) and Smith et al. (1995).

Hydroperiod: Timing, frequency, and duration of seasonal inundation and drying in a typical year.

Incised channel: A channel with a streambed lower in elevation than its historic elevation in relation to the floodplain (from Stream Visual Assessment Protocol; SVAP2).

In-lieu fee program: A program involving the restoration, establishment, rehabilitation, and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for Corps permits. Similar to a mitigation bank, an in-lieu fee program sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the in-lieu program sponsor. However, the rules governing the operation and use of in-lieu fee programs are somewhat different from the rules governing operation and use of mitigation banks. The operation and use of an in-lieu fee program are governed by an in-lieu fee program instrument. [33 CFR 332.2]

Intermittent stream: A stream that flows only certain times of the year, such as when it receives water from springs, ground water, or surface runoff (from Stream Visual Assessment Protocol; SVAP2).

Invasive species: Native and non-native species which aggressively invade areas, especially areas that are altered or disturbed, and displace less competitive native species. This often results in a near monoculture of the invasive species.

Metamorph: Name for a young amphibian that has just completed, or is close to completing metamorphosis to another life history stage. Metamorphosis is the process of growth and development of an amphibian (or other animal) from an egg through larval stages to become an adult.

Mitigation bank: A site, or suite of sites, where aquatic resources (e.g., wetlands, streams, riparian areas) are restored, established, enhanced, and/or preserved for the purpose of providing compensatory mitigation for impacts authorized by Corps permits. In general, a mitigation bank sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the mitigation bank sponsor. The operation and use of a mitigation bank are governed by a mitigation banking instrument. [33 CFR 332.2]

Mitigation (in relation to S.404): While federal mitigation includes sequencing from avoidance to minimization to, finally, compensation, the term is used in this document as the equivalent of "compensation."

Nickpoint: The point where a stream is actively eroding (downcutting) to a new base elevation. Nickpoints migrate upstream (through a process called headcutting) (from Stream Visual Assessment Protocol; SVAP2).

Ordinary High Water Mark (OHWM): "A line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, or the presence of litter and debris." (33 CFR 328.3(e)) It is the defining element for identifying the lateral limits of non-wetland waters.

Preservation: The removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms. Preservation does not result in a gain of aquatic resource area or functions.

Reach: A section of stream. When using the Stream Visual Assessment Protocol a reach is a section of stream with consistent characteristics. (See Stream Visual Assessment Protocol; SVAP2.

Re-establishment (restoration): The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/ historic functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions. This results in a restoration of area and functions. This is equivalent to the traditional use of the term "restoration."

Reference vernal pool: A minimally degraded vernal pool that is representative of expected ecological conditions. Reference pools serve as a standard for determining the health and integrity of other vernal pools in the same regional geomorphic setting. For geomorphic settings of vernal pools in the northeast, see Rheinhardt and Hollands (2008).

Rehabilitation: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area. This results in a restoration of FUNCTIONS to a degraded aquatic resource. Degradation may result from infestation by invasive species, partial filling that does not create upland, deliberate removal of woody species (natural changes such as flooding and subsequent demise of trees as a result of beaver activity is not degradation), partial draining, etc. Rehabilitation differs from enhancement in that rehabilitation is intended to result in a general improvement in the suite of the functions typically performed by an unaltered

reference aquatic resource. In contrast, enhancement activities often focus on increasing one or two functions, rather than improving the suite of functions being performed by an existing aquatic resource. Wetlands rehabilitation does not result in a gain in wetland acreage.

Restoration: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: reestablishment and rehabilitation. The traditional use of the term is equivalent to reestablishment.

Secondary impacts: Effects on an aquatic ecosystem that are associated with a discharge of dredged or fill materials, but do not result from the actual placement of the dredged or fill material (40 CFR 230.11(h)).

Stream: Unidirectionally flowing waters and their channels and their functionally associated riparian zones, which include rivers, brooks, creeks, branches, tributaries, and headwater streams. They may be periodically or seasonally non-flowing (intermittent or ephemeral) or continuously flowing (perennial).

Stream Creation: Establishing a stream reach where one did not exist.

Stream Enhancement: Rehabilitation; for example, the removal of riprap, installation of coarse woody material, re-establishment of connections with the stream's floodplain, re-establishment of a wooded riparian zone, re-establishment of a natural stream channel in a ditched or channelized stream, and/or revegetation or control of invasive plant control on stream banks.

Stream Restoration: Re-establishment of a stream reach, side channels or floodplain. Examples would be daylighting of a stream, removal of concrete channel, and removal of a dam and its impoundment.

Stream Scientist: A professional with training and/or experience in research and/or applied areas involving the physical, chemical and biological structure and functions of streams and rivers. Because of the complexity of streams, a stream scientist typically has interdisciplinary skills.

Target species: The target species is/are the species used to help define the mitigation plan habitat goals. It may be appropriate to design different parts of the plan to address each target species' habitat requirements, for example multiple pools with different hydroperiods.

Temporal loss: The time lag between the loss of aquatic resource FUNCTIONS caused by the permitted impacts and the fully functional replacement of

aquatic resource functions at the compensatory mitigation site(s) (33 CFR 332.2).

Vernal pool: Temporary to semipermanent bodies of water occurring in shallow depressions that typically fill during the spring and fall and may dry out during the summer or in drought years (*sensu* Calhoun and deMaynadier 2008).

Vernal pool breeding season: For the purposes of this document, the breeding season refers to the entire period of time necessary to complete the amphibian cycle from egg-laying through metamorphosis and emergence from the pool. The breeding season may vary regionally and annually, but generally begins between early to mid March (southern New England) and mid to late April (northern Maine). The breeding season ends when the pool dries out, usually by early summer. It should be noted that, in areas inhabited by marbled salamander (a fall breeder), breeding season observations should also be made in the fall (September to October).

Vernal pool critical terrestrial habitat: This is the area from 100 to 750 feet of the vernal pool's edge. The critical terrestrial habitat typically extends 750 feet from the vernal pool edge or 650 feet from the vernal pool envelope's outer edge and refers to the area outside of the breeding pool that supports the non-larval life-cycle stages of pool-breeding amphibian species.

Vernal pool edge: The outer boundary of a vernal pool, determined by the maximum observed or recorded extent of inundation. The boundary may be defined by a distinct topographic break in slope or by evidence of high water marks or other appropriate physical data.

Vernal pool directional buffer: An area that links critical habitats used by pool-breeding amphibians by incorporating migration corridors between post-breeding and breeding habitat, defined by portions of the vernal pool envelope, vernal pool critical terrestrial habitat, and connections between the two.

Vernal pool envelope: The area from the edge of the vernal pool to 100 feet outward. The edge defines the inner boundary of the envelope; the outer boundary is located 100 feet outward from the edge.

Vernal pool facultative species: Vertebrate and invertebrate species that frequently use vernal pools for at least a portion of their life cycle, but that normally meet other life cycle requirements in other types of waters, including wetlands.

Vernal pool indicator species: Vertebrate and invertebrate species that depend upon vernal pool habitat for meeting all or a critical portion of their life cycle requirements. These species serve as direct evidence of the presence of a

vernal pool. They may also be referred to as obligate or vernal pool-dependent species.

Watershed: A land area that drains to a common waterway, such as a stream, lake, estuary, wetland, or ultimately the ocean.

Watershed approach: An analytical process for making compensatory mitigation decisions that support the sustainability or improvement of aquatic resources in a watershed. It involves consideration of watershed needs, and how locations and types of compensatory mitigation projects address those needs. A landscape perspective is used to identify the types and locations of compensatory mitigation projects that will benefit the watershed and offset losses of aquatic resource functions and services caused by activities authorized by DA permits. The watershed approach may involve consideration of landscape scale, historic and potential aquatic resource conditions, past and projected aquatic resource impacts in the watershed, and terrestrial connections between aquatic resources when determining compensatory mitigation requirements for DA permits.

Watershed plan: A plan developed by federal, tribal, state, and/ or local government agencies or appropriate non-governmental organizations, in consultation with relevant stakeholders, for the specific goal of aquatic resource restoration, establishment, enhancement, and preservation. A watershed plan addresses aquatic resource conditions in the watershed, multiple stakeholder interests, and land uses. Watershed plans may also identify priority sites for aquatic resource restoration and protection. Examples of watershed plans include special area management plans, advance identification programs, and wetland management plans.

Wetland scientist: A professional with training and experience in research and/or applied science involving the physical and/or biological aspects of wetlands. Because of the complexity of wetlands, wetland science is an interdisciplinary field that includes ecologists, botanists, wildlife biologists, hydrologists, soil scientists, geomorphologists, geologists, aquatic biologists, and biogeochemists, among others. Applicants should consult with the Corps Project Manager to determine the appropriate expertise needed for a "wetland scientist" overseeing a particular project.

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APPENDIX C

BASIC MITIGATION PLAN

BASIC MITIGATION PLAN CHECKLIST

Project: ___
File No: ___
City: _____
State: _____
Plan Title: _____
Plan Preparer: _____
Plan Date: _____
Corps Project Manager: _____

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A.	**General Information**	**H.**	**Preservation**
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E.	**Erosion Controls**	**L.**	**Long-term Stewardship**
F.	**Invasive Species**	**M.**	**Financial Assurances**
G.	**Off-Road Vehicle Use**	**N.**	**Other Comments**

A. General Information

1. [ ] Mitigation plan and documentation submitted as one complete package.
2. [ ] Fully identify all elements of the proposed mitigation, including any payments into an In-Lieu Fee Program or Mitigation Bank (if all impacts are proposed to be covered by an ILF Program and/or Mitigation Bank, only Sections A and B need to be completed). When an ILF Program or Mitigation Bank is available but not proposed to be used, a justification is provided.
3. Mitigation site location(s) for permittee-responsible mitigation:
   a. [ ] Locus map(s)
   b. [ ] Aerial photo(s)
   c. [ ] Latitude/Longitude of mitigation site(s) in decimal format.
   d. [ ] 8-digit Hydrologic Unit Code(s) for mitigation area(s).

B. Impact area(s)

1. [ ] Wetland acreage at each impact site.
2. [ ] Cowardin classifications at each impact site.
3. [ ] HGM classifications at each impact site.

4. [ ] Other aquatic resources at each impact site.
   a. [ ] Vernal pools
   b. [ ] Streams
   c. [ ] Submerged Aquatic Vegetation
   d. [ ] Mudflats
5. [ ] Describe both site specific and landscape level wetland and stream functions and values at each impact site.
6. [ ] Describe type and purpose of work at each impact site.
7. [ ] Relationship of impact area(s) to watershed or regional plans for the area discussed.
8. [ ] 8-digit Hydrologic Unit Code(s) for impact area(s).

C. Mitigation area(s)

1. Background information
   a. [ ] Mitigation alternatives.
   b. [ ] Existing wildlife use.
   c. [ ] Existing soil.
   d. [ ] Existing vegetation.
   e. [ ] Surrounding land uses.
   f. [ ] USFWS and/or NOAA Clearance Letter or Biological Opinion.
   g. [ ] SHPO/THPO Cultural Resource Clearance Letter.
2. Mitigation proposed
   a. [ ] Wetland acreage proposed at each site.
   b. [ ] Cowardin classifications proposed at each site.
   c. [ ] HGM classifications proposed at each site.
   d. [ ] Other aquatic resources proposed at each site.
      i. [ ] Vernal pools
      ii. [ ] Streams
      iii. [ ] Submerged Aquatic Vegetation
      iv. [ ] Mudflats
   e. [ ] Site-specific and landscape-level functions and values proposed at each site.
   f. [ ] Target fish and/or wildlife species.
   g. [ ] Reference site(s).
   h. [ ] Design Constraints.
   i. [ ] Construction oversight.
   j. [ ] Project construction timing.
   k. [ ] Responsible parties for all aspects of project.
   l. [ ] Potential to attract waterfowl and other bird species that might pose a threat to aircraft?
3. Specific Aquatic Resource Checklist Information Appended
   a. [ ] Wetlands
   b. [ ] Vernal pools
   c. [ ] Submerged aquatic vegetation
   d. [ ] Streams
   e. [ ] Other aquatic resources

D. Grading Plan

1. Plan View
   a. [ ] Existing and proposed grading plans.
   b. [ ] Microtopography
   c. [ ] Scale is in the range of 1"=20' to 1"=100'.
   d. [ ] All items on the plan are legible. Electronic documents are encouraged (e.g., PDF); otherwise plans should be on 8 ½ x 11" sheets.
   e. [ ] Plans have a bar scale.
   f. [ ] The drawings show the access for maintenance and monitoring.
2. [ ] Representative cross-sections.
3. [ ] Other - Specific staff recommendations related to grading.

E. Erosion Controls

[ ] Erosion control removal deadline is included.

F. Invasive Species

[ ] Invasive Species Control Plan (ISCP) is included.
   a. [ ] Risks – includes evaluation of the potential for unwanted species or varieties.
   b. [ ] Constraints – regulatory or environmental factors affecting control strategies.
   c. [ ] Addresses a scope commensurate with risk & constraints.

G. Off-Road Vehicle Use

1. [ ] No off-road vehicle use in immediate vicinity, or if so, control measures addressed.
2. [ ] Control plan, if appropriate.

H. Site Protection

1. [ ] Adequate buffers.
2. [ ] Wetlands within subdivisions are protected along with appropriate buffers.
3. [ ] Required preservation language is included.
4. [ ] Plans of preservation area(s).
5. [ ] Form of legal means of preservation.
6. [ ] Documentation of acceptance by receiving agency (if applicable).

I. Monitoring

[ ] Appropriate monitoring is proposed and language included.
[ ] Project Overview Form will be included with each Annual Monitoring Report.
[ ] Transmittal and Self-Certification Form will be included with each Annual Monitoring Report.

J. Assessment

[ ] An appropriate final assessment is proposed and language included.

K. Contingency

[ ] Plan for dealing with unanticipated site conditions or changes.

L. Long-term Stewardship

[ ] Plan for long-term stewardship is included.
[ ] Documentation of acceptance by the receiving steward (if applicable).

M. Financial Assurances

[ ] Appropriate financial assurances in place:
  a. [ ] Construction
  b. [ ] Monitoring and remediation
  c. [ ] Contingency
  d. [ ] Long-term stewardship (endowment)

N. Other Comments

BASIC MITIGATION PLAN CHECKLIST DIRECTIONS

A. General Information
B. Impact Area(s)
C. Mitigation Area(s)
D. Grading Plans
E. Erosion Controls
F. Invasive Species
G. Off-Road Vehicle Use
H. Preservation
I. Monitoring
J. Assessment
K. Contingency
L. Long Term Stewardship
M. Financial Assurances
N. Other Comments

All checklist items should be included in the mitigation plan or there should be an explanation as to why they are not appropriate. While most of these items will be needed for most mitigation plans, a few items included here will need to be modified for specific resource types (see following guidance).

After Corps review, items <u>not</u> marked with X (included), N/A (Not Applicable), or NONE should be addressed by the applicant, as well as any comments under any item.

The ➡ used throughout this document indicates text which should typically be included in the mitigation plan.

Many items on the checklist are self-explanatory. Those which require specific guidance or clarification are noted below. Basic project information as noted in the main portion of the checklist should be included in every mitigation plan. Information noted in specific resource modules should be submitted for any project which includes mitigation involving the specific resource(s), e.g., nontidal wetlands, vernal pools, SAV, etc.

A. GENERAL INFORMATION

1. To avoid confusion, all mitigation proposal materials should be submitted as a single package without extraneous information that is needed for the permit evaluation but is not pertinent to the mitigation itself. A complete mitigation plan is important so that it may be cited in the permit and be easily used for permit compliance.

2. All elements of the full mitigation proposal should be fully identified in detail, including any payments into an In-Lieu Fee Program or purchase of credits from a Mitigation Bank. (Note that, if permittee-responsible mitigation is proposed, a rationale for not using a bank or ILF program should be provided.)

3. a. Locus maps that show the location of the impact area and the location of all permittee-responsible mitigation sites – including preservation areas – are critical components of the plan. They should depict the geographic relationship between the impacted site(s) and the proposed mitigation site(s) and include a vicinity map of approximately 1 inch equals 2,000 feet. For sites where the relationship between the impacted site(s) and proposed mitigation site(s) is not clear at USGS quadrangle scale, an additional plan should be provided at an appropriate scale.

3.b. Aerial photographs, if available, should be included. There are several on-line sources available. Recent photographs are preferred.

3.c. Longitude and latitude of the mitigation site(s), including preservation areas, should be given in decimal format, rather than degrees and minutes or UTMs.

3.d. Watershed(s) must be identified using the USGS 8-digit Hydrologic Unit Code(s) for each impact and mitigation site (See Item A.2 on the Checklist), including preservation sites. One source of these codes is an EPA's "Surf your Watershed" website at:

B. IMPACT AREA(S)

Impact areas include both wetlands and waters. Most of the checklist items are self-explanatory but clarification is provided for stream information, functions and values assessment, and watershed plans.

2. Wetlands and/or waters at each impact site should be described using Cowardin, et al.[3] 1979 and Tiner 2014[4].

3. Wetlands at each site should be described using the hydrogeomorphic[5] classification system.

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[3] Cowardin, et. al. (1979) "Classification of wetlands and deepwater habitats of the United States," Office of Biological Services, FWS/OBS-79/31, December 1979

[4] Tiner, R.W. 2014. *Dichotomous Keys and Mapping Codes for Wetland Landscape Position, Landform, Water Flow Path, and Waterbody Type Descriptors: Version 3.0*. U.S. Fish and Wildlife Service, National Wetlands Inventory Program, Northeast Region, Hadley, MA. 65 pp.

[5] Brinson, M. M. (1993). "A hydrogeomorphic classification for wetlands," Technical Report WRP-DE-4, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. NTIS No. AD A270 053.

4.a. Descriptions of the vernal pool(s) should be documented using the Corps' Vernal Pool Characterization Form (see Appendix L) or similar form.

4.b. If any streams will be impacted, information needed includes length of stream to be impacted, nature of banks, normal seasonal flows, gradient, sinuosity, bed load, lengths of riffles and pools, and adjacent landscape. Completed Stream Visual Assessment Protocol Worksheet is provided per SVAP2. Note that the Mitigation Rule references the need for mitigation of impacts to all aquatic resources.

4.c. Include information on variability and extent of bed size.

5. When performing functions and values assessments, simply stating "wildlife habitat" or "fishery habitat" is inadequate. Additional information needs to be provided. Provide indicator species for the habitat type such as forest-dwelling migratory birds or mole salamanders and/or woodfrogs for a vernal pool. The more specific the information, the more confidence the Corps will have in the evaluation.

7. Watershed and/or regional plans that describe aquatic resource objectives should be discussed if such plans are available for the impact area(s). If no such plans exist, this should be stated.

C. MITIGATION AREA(S)

1.a. Provide an explanation of sites and methodologies considered for mitigation activities and the rationale for selection or rejection. The Mitigation Rule discusses when use of a potential mitigation site is practicable, whether on-site or off-site mitigation is appropriate, and whether out-of-kind mitigation is appropriate instead of in-kind. In order to replace the impacted functions, in-kind mitigation is generally preferred unless the impacted site is heavily degraded, or potential exists to restore a historically extant but now regionally rare wetland type, e.g., an Atlantic white cedar swamp or circumboreal spruce-fir wetland.

1.b. – e. Information on the selected site(s)'s existing wildlife usage, soils, vegetation, and surrounding land use are needed. **Wildlife usage** should include information on any probable state and federal threatened and endangered species habitat. Subsurface **soil conditions** have a critical role in mitigation design, whether the substrate is sand, loam, silt, clay, and/or bedrock. Therefore, soil profiles should be provided that extend down to at least two feet below the proposed new soil surface. Since much of New England has been and continues to be heavily developed, there is a potential for industrial and agricultural contaminants in the soil. Although contamination does not necessarily preclude the use of a site, testing that is commensurate with the risk may be needed. Describe the existing **vegetation** on the site including a list of species, dominant species, density, community types, and community structure. **Surrounding land use** should be described within at least 500 feet of the site(s) and include a discussion of likely <u>future</u> land uses.

Include a discussion of how the site(s) plans fit into the watershed context and the proximity of the site to public and private protected lands.

1.f. USFWS and/or NOAA Clearance Letter or Biological Opinion is for the mitigation site(s) and necessary to ensure that threatened or endangered species will not be impacted by the mitigation. This is not necessarily addressed in those agencies' comments on the proposed project that requires the mitigation.

1.g. SHPO/THPO letters on the proposed project also may not address potential concerns at the mitigation site, so evidence of coordination with these parties concerning possible effects to historic properties must be provided for the mitigation site(s).

2.a. – d. Similar information is required for the mitigation area(s) as for the impacted area(s). Along with mitigation acreage at each site, the type of mitigation (i.e., creation, restoration, enhancement, preservation) should be identified. A single mitigation site may not be able to provide the full range of functions desired because some functions are incompatible. For example, some wildlife habitat may not be compatible with flood storage.

2.h. Frequently mitigation designs are constrained by the project itself, landscape features, or public issues that control or otherwise influence the design and/or monitoring and remediation of the mitigation area. Such constraints need to be explained in detail. If there are no constraints (rare), that should be stated in the plan.

2.i. To ensure that someone with expertise in the specific aquatic resource(s) being mitigated provides construction oversight for the mitigation project, the following language should be included in the narrative portion of the mitigation plan:

➡ A wetland scientist/coastal habitat scientist/stream scientist **[choose appropriate for project]** shall be on-site to monitor construction of the mitigation area(s) to ensure compliance with the mitigation plan and to make adjustments when appropriate to meet mitigation goals.

2.j. Construction timing of the mitigation and the proposed aquatic resource impacts affects temporal impacts. Therefore, the following language should be included in the narrative portion of the mitigation plan:

➡ Compensatory mitigation shall be initiated not later than 90 days after initiation of project construction and completed not later than one year after the permitted aquatic resource impacts occur.

2.k. All parties responsible for the implementation, performance, and long-term management of the mitigation project are identified.

2.l. Wildlife can pose serious threats to aircraft and therefore mitigation sites near airports are of concern to the Federal Aviation Administration. Indicate how far the nearest airport is from the site. See Federal Aviation Administration Advisory Circular AC No: 150/5200-33B Hazardous Wildlife Attractants on or Near Airports, 8/28/2007

3. Identify what specific aquatic resource checklist information is included.

D. GRADING PLANS

1. a. Plan provides existing and proposed grading plans for mitigation area. Existing contours should be no greater than 2' intervals. Proposed contours should be to 1' intervals (some situations such as salt marsh restoration will require finer intervals) in the wetlands portion of the mitigation with spot elevations for intermediate elevations. All other areas should be shown at 2' contour intervals.

1.b. Where microtopographic variation is planned, the proposed maximum differences in elevation should be specified. The plan does not need to show the locations of each pit and mound as long as a typical cross-section and approximate number of pits and mounds is given for each zone.

1.d. Plans should be in black and white on 8 ½ x 11" sheets. Large format sheets are encouraged for clarity, but only as a supplement to the letter-sized sheets. Color reproductions of large format sheets should also be submitted in electronic form but should not be part of the formal plan as the color is lost during digitization of files.

1.f. The drawings should show the access for maintenance and monitoring.

2. Plan provides representative cross sections showing the existing and proposed grading plan, expected range of shallow groundwater table elevations or surface water level consistently expected. Cross-sections should include key features such as upland islands and pools. They should extend beyond the mitigation site into adjacent wetlands and uplands.

E. EROSION CONTROLS

The following language is included in the mitigation plan, either in the drawings or in the narrative portion of the plan:

→ Temporary devices and structures to control erosion and sedimentation in and around mitigation sites shall be properly maintained at all times. The devices and structures shall be disassembled and properly disposed of as soon as the site is stable but no later than November 1, three full growing periods after planting. Sediment collected by these devices will be removed and placed upland in a manner that prevents its erosion and transport to a waterway or wetland.

F. INVASIVE AND NON-NATIVE SPECIES

The mitigation plan should include an Invasive Species Control Plan (ISCP).

a. The discussion of risk should include an assessment of the potential for invasion of the wetland by Common reed (*Phragmites australis*), Purple loosestrife (*Lythrum salicaria*), Smooth and Common buckthorns (*Frangula alnus* and *Rhamnus cathartica*), Russian and Autumn olives (*Elaeagnus angustifolia* and *E. umbellata*), Multiflora rose (*Rosa multiflora*), Reed canary-grass (*Phalaris arundinacea*), Japanese knotweed (*Fallopia japonica*), or other identified problematic species specific to this project or site.

b. The plan should identify regulatory and ecological constraints that influence the design of any plan to control invasive plants and animals by biological, mechanical, or chemical measures. For example, if a state requires a permit for use of herbicide, this may constrain attempts to control an invasive plant species. If there are no constraints, this should be stated.

c. The plan should describe the strategy to control, or recognize and respond to, the degradation of the mitigation site by invasive or non-native plants, particularly those listed in F.a. above.

G. OFF-ROAD VEHICLE USE

If there is a potential for off-road vehicle access at the site, including snowmobile usage, the mitigation plan shall include a strategy to minimize impacts. Plans should illustrate locations of any necessary barriers placed at access points to the mitigation sites to prevent vehicles from damaging the sites.

H. SITE PROTECTION

1. Adequate buffers must be proposed to protect the ecological integrity of creation, restoration, and/or enhancement areas.

2. Wetlands within subdivisions, golf courses, etc. should generally be protected along with adequate buffers. This is part of the avoidance and minimization steps of mitigation, not part of compensation.

3. Site protection should be part of every mitigation package as preservation of a creation, restoration, or rehabilitated area, and buffer; the remaining unimpacted aquatic resources on-site as part of avoidance and minimization; as a stand-alone form of mitigation; or as any combination of these. Ideally the preservation document will be prepared, then reviewed and approved by the Corps prior to

submission of the final mitigation plan and permit issuance. If this is not possible, the following language should be included in the plan[6]:

→ Compensatory mitigation sites and on-site unimpacted aquatic resources (and buffers) to be set aside for conservation shall be protected in perpetuity from future development. Within 90 days of the date this permit is issued and prior to initiation of permitted work in aquatic resources, the permittee shall submit to the Corps of Engineers a draft of the conservation easement or deed restriction. Within 30 days of the date the Corps approves this draft document in writing, the permittee shall execute and record it with the Registry of Deeds for the Town of _____ and the State of _____. A copy of the executed and recorded document must then be sent to the Corps of Engineers within 120 days of the date the Corps approves it. The conservation easement or deed restriction shall enable the site or sites to be protected in perpetuity from any future development. For preservation as part of compensation, the conservation easement or deed restriction shall expressly allow for the creation, restoration, remediation and monitoring activities required by this permit on the site or sites. It shall prohibit all other filling, clearing and other disturbances (including vehicle access) on these sites except for activities explicitly authorized by the Corps of Engineers in these approved documents.

If it is possible to have the document prepared and approved prior to final mitigation plan submission and permit issuance, only the following needs to be included:

→ Within 30 days of the date of permit issuance and prior to initiation of permitted work in aquatic resources, the permittee shall execute and record the preservation document with the Registry of Deeds for the Town of - _____ and the State of _____. A copy of the executed and recorded document must then be sent to the Corps of Engineers within 120 days of the date the Corps approves it.

4. Plans showing the location of all sites to be preserved are required. In addition to a locus, they must be sufficiently detailed to determine relationships to adjacent development and/or properties as these adjacent areas affect the long term sustainability of the site. In some cases it may be appropriate to have signs at the boundaries of the preservation area(s). The sign design should be noted in the documentation.

5. The form should be specified or a copy of the document(s) included.

[6] Departments of Transportation, in particular, may need to have the timing requirements modified. This will be addressed on a case-by-case basis.

I. MONITORING

The following language, through performance standards (specific to the project), should be included in the narrative portion of the mitigation plan:

MONITORING

Notification of Construction Completion

Within 60 days of completing a mitigation project that includes restoration, creation, and/or enhancement, the applicant will submit a signed letter to the Corps, Policy Analysis and Technical Support Branch, specifying the date of completion of the mitigation work and the Corps permit number.

If mitigation construction is initiated in, or continues throughout the year, but is not completed by December 31 of any given year, the permittee will provide the Corps, Policy Analysis and Technical Support Branch, a letter providing the date mitigation work began and the work completed as of December 31. The letter will be sent no later than January 31 of the next year. The letter will include the Corps permit number.

Monitoring Report Guidance

For each of the first **[specify number]** full growing periods following construction of the mitigation site(s), the site(s) will be monitored and annual monitoring reports submitted. Observations will occur at least two times during the growing period – in late spring/early summer and again in late summer/early fall. Each annual monitoring report, in the format provided in the New England District Compensatory Mitigation Guidance, will be submitted to the Corps, Regulatory Division, Policy Analysis and Technical Support Branch, no later than December 15 of the year being monitored. Failure to perform the monitoring and submit monitoring reports constitutes permit non-compliance. A self-certification form[7] will be completed and signed as the transmittal coversheet for each annual monitoring report and will indicate the permit number and the report number (Monitoring Report 1 of 5, for example). The reports will address the following performance standards in the summary data section and will address the additional items noted in the monitoring report requirements, in the appropriate section. The reports will also include the monitoring-report appendices. The first year of monitoring will be the first year that the site has been through a full growing period after completion of construction and planting. For these permit special conditions, a growing period starts no later than May 31. However, if there are problems that need to be addressed and if the measures to correct them require prior approval from the Corps, the permittee will contact the Corps by

[7] see Appendix J

phone (1-800-362-4367 in MA or 1-800-343-4789 in ME, VT, NH, CT, RI) or letter as soon as the need for corrective action is discovered.

Remedial measures will be implemented - at least two years prior to the completion of the monitoring period - to attain the success standards described below within **[specify number]** growing periods after completion of construction of the mitigation site(s). Should measures be required within two years of the end of the original monitoring period, the monitoring period will be extended as necessary to ensure two years of monitoring after the remedial work is completed. Measures requiring earth movement or changes in hydrology will not be implemented without written approval from the Corps.

At least one reference site adjacent to or near each mitigation site will be described and shown on a locus map.

Performance Standards

[Specific performance standards for the project should be included here. See list of examples in Section I.5. These are ONLY EXAMPLES and specific performance standards should be individually crafted for each compensatory mitigation project.]

Monitoring Report Requirements

Monitoring reports should generally follow a 10-page maximum report format per site, with a self-certification form transmittal[8]. Submission of electronic formats (e.g., pdf) is strongly encouraged. The information required should be framed within the following format.

1) Project Overview[9] (1 page)

   Highlighted summary of problems which need immediate attention (e.g., problem with hydrology, severe invasive species problem, serious erosion, major losses from herbivory, etc.). This should be at the beginning of the report and highlighted in the self-certification form and the project overview (Appendices E and F).

2) Requirements (1 page)

   List all mitigation-related requirements as specified in the approved mitigation plan and special conditions of the permit including: the monitoring and performance and/or success standards, required financial assurances, required preservation, etc., and note whether required

[8] see Appendix J
[9] see Appendix K

documents have been provided and evaluate whether the compensatory mitigation project site is successfully achieving the approved performance and/or success standards or trending toward success.

3) Summary Data (maximum of 4 pages)

Summary data must be provided to substantiate the success and/or potential challenges associated with the compensatory mitigation project. Photo documentation should be provided to support the findings and recommendations, and placed in the Appendix.

- Address performance standards achievement and/or measures to attain the standards.

- Describe the monitoring inspections, and provide their dates, that occurred since the last report.

- Soils data, commensurate with the requirements of the soils portion of the most recent Corps of Engineers Wetland Delineation Manual and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast should be collected after construction and every alternate year throughout the monitoring period. If IRIS tubes (see below), monitoring wells, or gauges were installed as part of the project, this hydrology data should be submitted annually.

Recommended Indicator of Reduction in Soils (IRIS) Tube Placement and Data Collection (summarized from the 2008 document entitled *Protocol for Using and Interpreting IRIS Tubes*).

a. IRIS Tubes should be installed during the time of the growing season anticipated to have the highest amount of soil reduction (often in the early growing season). They should be installed in a representative portion of the mitigation site, rather than in the lowest/wettest areas. Additional IRIS tube samples should be taken for larger sites and sites with higher changes in elevation.
b. Create a pilot hole in the soil using a 7/8" push probe.
c. Be sure tubes are labelled.
d. Insert the IRIS tube into the hole until the mark on the tube is at the soil surface (50 cm). If they are installed to shallower depths, mark the depth of the soil surface with a permanent marker.
e. Install five replicates, up to a meter apart, within the study area.
f. Tubes should be left in place for two to four weeks. Then should be removed and replacement tubes can be installed in the same holes for an additional two to four weeks.
g. Gently wash off any adhering soil from the tubes.

h. Estimate the amount of paint removed from each tube.
i. To improve accuracy, have two people estimate the amount of paint removed, then average the two sets of data.
j. Find a six inch area on the tube, entirely within the upper 12 inches, with the most paint removed. Estimate the percentage of paint removed from this six inch area.
k. To meet the Technical Standard for reducing soil conditions as currently specified in the National Technical Committee on Hydric Soils, 30% or more of paint within this six inch section must be removed.
l. At least three of the five replicates must show this paint removal for the soil to demonstrate that it is reducing.
m. Include a copy of the plan showing the location of the IRIS tubes, summarize the information, and, if relevant, provide monthly rainfall data for the areas.

- Concisely describe remedial actions done during the monitoring year to meet the performance or success standards – actions such as removing debris, replanting, controlling invasive plant species (with biological, herbicidal, or mechanical methods), regrading the site, applying additional topsoil or soil amendments, adjusting site hydrology, etc. Also describe any other remedial actions done at each site.

- Report the status of all erosion control measures on the compensation site(s). Are they in place and functioning? If temporary measures are no longer needed, have they been removed?

- Give visual estimates of (1) percent vegetative cover for each mitigation site and (2) percent cover of the invasive species listed under Success Standard No. 3, above, in each mitigation site.

- What fish and wildlife use the site(s) and what do they use it for (nesting, feeding, shelter, etc.)?

- By species planted, describe the general health and vigor of the surviving plants, the prognosis for their future survival, and a diagnosis of the cause(s) of morbidity or mortality.

4) Maps/Plans (maximum of 3 pages)

Maps must be provided to show the location of the compensatory mitigation site relative to other landscape features, habitat types, locations of photographic reference points, transects, sampling data points, and/or other features pertinent to the mitigation plan. In addition, the submitted maps/plans must clearly delineate the mitigation site boundaries to assist in proper locations for subsequent site visits. Each map or diagram must

fit on a standard 8 ½ x 11" piece of paper and include a legend, bar scale, and the location of any photos submitted for review. Plans should be at the same orientation and scale as those found in the original mitigation plan attached to the permit.

5) Conclusions (1 page)

A general statement must be included describing the conditions of the compensatory mitigation project. If performance or success standards are not being met, a brief discussion of the difficulties and potential remedial actions proposed by the permittee, including a timetable, must be provided.

6) Monitoring Report Appendices

Appendix A -- An as-built plan showing topography to 1-foot contours, any inlet/outlet structures and the location and extent of the designed plant community types (e.g., shrub swamp). Within each community type the plan shall show the species planted—but it is not necessary to illustrate the precise location of each individual plant. There should also be a soil profile description and the actual measured organic content of the topsoil. This should be included in the first monitoring report unless there is grading or soil modifications or additional plantings of different species in subsequent years.

Appendix B – A vegetative species list of each plant community type. The species list should, at a minimum, include those that cover at least 5% of their vegetative layer. The list should include both planted and volunteer species.

Appendix C -- Representative photos of each mitigation site taken from the same positions, angles, and magnification for each monitoring event. Photos should be dated and clearly labelled with the direction from which the photo was taken. The photo sites must also be identified on the appropriate maps.

J. ASSESSMENT

The following language (the remainder of item J.) should be included in the narrative portion of the mitigation plan:

→ **ASSESSMENT**

A post-construction assessment of the condition of the mitigation site(s) shall be performed following the fifth growing period (Year 5) after completion of the mitigation site(s) construction, or by the end of the monitoring period, whichever is later. "Growing period" in this context begins no later than May 31st. To ensure objectivity, the person(s) who prepared the annual monitoring reports shall not perform this assessment without written approval from the Corps. The

assessment report shall be submitted to the Corps by December 15 of the year the assessment is conducted; this will coincide with the year of the final monitoring report, so it is acceptable to include both the final monitoring report and assessment in the same document.

The post-construction assessment shall include the four assessment appendices listed below and shall:

- Summarize the original or modified mitigation goals and discuss the level of attainment of these goals at each mitigation site.

- Describe significant problems and solutions during construction and maintenance (monitoring) of the mitigation site(s).

- Identify agency procedures or policies that encumbered implementation of the mitigation plan. Specifically note procedures or policies that contributed to less success or less effectiveness than anticipated in the mitigation plan.

- Recommend measures to improve the efficiency, reduce the cost, or improve the effectiveness of similar projects in the future.

ASSESSMENT APPENDICES:

Appendix A -- Summary of the results of a functions and values assessment of the mitigation site(s), using the same methodology used to determine the functions and values of the impacted wetlands.

Appendix B -- Calculation of the area by type (e.g., wetlands, vernal pools) of aquatic resources in each mitigation site. Wetlands should be identified and delineated using the Corps Wetlands Delineation Manual and approved regional supplements. Supporting documents shall include (1) a scaled drawing showing the aquatic resource boundaries and representative data plots and (2) datasheets for the corresponding data plots.

Appendix C -- Comparison of the area and extent of delineated constructed aquatic resources (from Appendix B) with the area and extent of created aquatic resources proposed in the mitigation plan. This comparison shall be made on a scaled drawing or as an overlay on the as-built plan. This plan shall also show any major vegetation community types.

Appendix D -- Photos of each mitigation site taken from the same positions, angles, and magnifications as the monitoring photos.

K. CONTINGENCY

Describe the procedures to be followed should unforeseen site conditions or circumstances prevent the site from developing as intended. Examples of such situations include but are not limited to, unanticipated beaver activity, disruption of the groundwater by blasting or other construction in the vicinity, unexpected subgrade texture, unearthing an unexpected archaeological site, and/or encountering hazardous waste.

L. LONG TERM STEWARDSHIP

Appropriate provisions must be made to support the mitigation site in perpetuity. The owner of the site or the holder of a conservation easement will be responsible for ensuring the mitigation site(s) is in compliance with the permit in perpetuity.

A long-term management plan must be developed and approved by the Corps. This plan may be modified periodically to address changing circumstances.

M. FINANCIAL ASSURANCES

In accordance with national guidance, financial assurances will be required when the Corps determines it is appropriate to ensure successful implementation of the mitigation[10], to include mitigation construction and monitoring, including remedial actions, and a long-term stewardship endowment. Assurances for construction and monitoring will include most projects where the mitigation work is not accomplished in its entirety prior to the permitted impacts to aquatic resources.

The text to use when such assurances are required is:

→ The permittee will post a performance bond for $_____ for construction of the wetland mitigation, monitoring, and potential remedial action as determined by the Corps of Engineers. This figure was based on the attached worksheet of construction and monitoring costs, plus a specified inflation factor, plus a 10% contingency. The bond shall be in the form of a firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570[11]. The bond must be in place at all times the

[10] In the case of state agencies and other federal agencies which cannot provide bonds, letters of credit, or the like, this issue may be addressed by providing a copy of obligation language which includes funding for the mitigation construction, required number of years of monitoring (including providing reports to the Corps), and appropriate remedial actions.

[11] Treasury Department Circular 570 is published in the Federal Register, and may be obtained from the U.S. Department of Treasury, Financial Management Service, Surety Bond Branch, 401 14th Street, NW, 2nd Floor, West Wing, Washington, DC 20227, or found via internet search.

construction is underway and during the entire monitoring period, including any extensions required by the Corps of Engineers to ensure permit compliance. Permitted impacts to aquatic resources will not occur until the Corps has approved the bond format, the bond has been executed, and the original **[assumes the Corps is the obligee]** has been provided to the Corps.

Upon completion of construction and written concurrence from the Corps, the bond may be reduced to an amount that will cover the costs of monitoring and possible remedial actions.

Note that other forms of acceptable security may be possible such as an escrow account, postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. However, please discuss alternatives to performance bonds with the Corps prior to their use.

N. OTHER COMMENTS

These will be provided by the Corps case-by-case.

APPENDIX D

WETLANDS MODULE

WETLANDS MODULE DISCUSSION

Microtopography

Note that natural wetland systems, particularly those with trees and/or shrubs, typically have an intricate pattern of topographic relief. Created or restored areas should have variability (elevational and size) similar to the impacted resource or other suitable reference area.

Soil

Manmade topsoil shall consist of a mixture of equal volumes of organic and mineral materials. Well-decomposed clean leaf compost is the preferred soil amendment to achieve these standards. Note that "clean" refers both to a negligible amount of physical contaminants such as plastic and to the lack of chemical contaminants that might pose a hazard to plants or animals. If other soil amendments are more readily available than clean leaf compost, they can be used to meet the requirement for the appropriate percent organic carbon content. Note, however, that compost or other organic matter should be clean and free of weed seeds, specifically the seeds of the species listed in Appendix I. Commercial peat is not recommended for soil amendments as its harvesting methods are generally destructive to wetlands. Caution should be used when using non-commercial peat salvaged from project impact sites as the chemical composition of that material may not be adequately buffered against phytotoxic levels of pH. This has resulted in the failure of some mitigation sites.

It is important to keep in mind the difference between organic *matter* and organic *carbon* both for meeting regulatory guidelines and when classifying the surface horizons in soils as histic (organic soils), mucky modified, or mineral. The organic *carbon* content of most upland topsoil is between 1 and 6 percent of dry weight. Soils with more than 20 to 30 percent organic *matter* (12 to 17 percent organic *carbon* content) are known as organic soils or Histosols if in a layer of adequate thickness. The Field Indicators for Identifying Hydric Soils in New England (New England Hydric Soils Technical Committee, 2004, 3rd ed.) glossary defines the criteria for these classifications based on their organic *carbon* contents. A minimum organic *carbon* content of 4-12% (7 to 21 percent organic *matter*) on a dry weight basis for soils should be used in wetland replication areas. The rule of thumb for conversion is to divide percent organic *matte*r by 1.72 to get percent organic *carbon*

content and multiply percent organic *carbon* by 1.72 to get percent organic *matter* content[12]:

$$\%O_m / 1.72 = \%O_c \quad \text{and} \quad \%O_c \times 1.72 = \%O_m$$

Scrub-shrub and forested wetlands should have about 12% organic carbon; emergent wetlands in permanently or semi-permanently inundated areas may only need 4-6%. Under certain circumstances, increased organic matter can lead to acidification of the soil, which damages the soil microbial community and the vegetation. Care should be taken to properly evaluate the soil and hydrology proposed for a site to prevent this from occurring.

Note that the term "loam" that is frequently used for the material spread on a mitigation site after subsoil grading is a landscaping term. In soil science, the term refers to a specific texture of soil comprised of specific amounts of sand, silt, and clay particles. The landscaping term is not a scientific term and should be avoided.

When topsoil must be stockpiled on site, the plan should include plans for maintaining moisture in the soil. The following measures are suggested for the contractor doing the work:

- Soil should not be stockpiled in wetlands or waters
- Seek approval for location of stockpiled materials (from owner/engineer);
- Avoid stockpiling compost organics in piles over 4 feet in height;
- Protect stockpiles from surface water flow and contain them with hay bales and/or silt fence;
- Cover stockpiles with a material that prevents erosion (tarps, erosion control mat, straw and temporary seed, depending on size and duration of storage)
- Inspect and repair protection measures listed above regularly (weekly), as well as prior to (to the extent possible) and after storm events.
- Maintain moisture in the soils during droughty periods.

Soil Compaction - Soil compaction by heavy machinery may adversely affect plantings and/or may result in perching of water. Therefore, efforts should be made to minimize soil compaction area during grading of the mitigation site. If use of heavy machinery cannot be avoided, compaction must be addressed by disking or some other treatment to loosen the soil surface. Finer grained soils are more susceptible to compaction than more coarsely grained soils, so clayey soils should not be worked at all except in extremely dry condition. Similar consideration should be given while spreading the topsoil.

[12] Excerpted from Allen, Art, "Organic Matters", *AMWS Newsletter*, December 2001.

Coarse Woody Material

Coarse woody material includes such materials as logs (ideally, a mix of hardwoods for longevity and softwoods), stumps, smaller branches, and standing snags but not woodchips or mulch made from wood. Placement of this material is generally inappropriate in tidal or frequently flooded environments unless it is appropriately anchored, and may not be appropriate for some herbaceous systems. As much as possible, these materials will be in various stages of decomposition and salvaged from natural areas cleared for the other elements of the project. Where floodwaters are a factor, it may be practical to anchor or partially bury snags and other larger components of woody material. In fact, large woody material in stream channels performs many stream functions including retention of sediment and nutrients, creation and maintenance of pools, and complex habitats for aquatic biota. Beaver, by cutting and redistributing large woody material, create ponds and wetlands that add diverse aquatic resource habitats.

When mitigation requires a component of forest or scrub-shrub habitat, the design should include plans for a continuum of coarse woody material, including snags (standing dead trees). This continuum should include a full range of sizes, including small twigs and brush, not merely larger logs, stumps, and snags. Woody material also plays an important role in vernal pool habitat by providing egg mass attachment sites in the pool basin and terrestrial refuges in the adjacent terrestrial habitat.

When a tree dies, it may continue to provide habitat for another century or longer. The speed of the recycling processes depends on many factors, but the main point is that coarse woody materials are relatively durable and remain as important ecological features both below- and above-ground for a long time. Long after the last needles or leaves fall to the forest floor, a tree decomposes slowly over time.

In the first years, if a tree remains upright, the greatest volume of its litter may consist of bark, twigs, and small branches. Later, as insects and fungus weaken the aerial framework, larger limbs and sections of the trunk tumble to the ground where decay occurs under quite different conditions. On the forest floor, well-decomposed logs may sustain greater faunal richness. In an ideal situation, there is an uninterrupted supply of woody litter in various sizes and stages of decay providing a diverse range of habitats. Decomposition is one of the natural processes in a healthy forest. If one link of the chain is lacking, the process falters. Wetland builders should factor coarse woody material into most habitat mitigation strategies.

Frequently the inclusion of scattered various sized boulders, as well as woody material, is an appropriate method of increasing structure and habitat in a site. NOTE: if not properly screened by a wetland scientist, coastal habitat scientist, stream scientist etc., such material can be a source of invasive species.

Tidal Wetland Establishment

Planting zones should be based on species requirements and a tidal datum. Each species must be planted at the appropriate elevation for that species and at the proper depth. Following grading, a survey shall be conducted to determine if supplemental backfill materials need to be placed to achieve required elevations for planting. If necessary, supplemental backfill shall be applied and then allowed to settle for a minimum of six tidal cycles prior to planting.

The potential for establishment of *Phragmites australis* and *Lepidium latifolium* is an important consideration in the design of tidal wetlands. Selected backfill material should be free of seed and vegetative propagules of *Phragmites*. For freshwater tidal wetlands, *Lythrum salicaria* may also be a species of concern.

The elevation of low marsh should be identified and considered in the design and should be provided in the plan. Low marsh plants should be planted between mean tide level and mean high water. High marsh plants should be planted between mean high water and spring high water. Salt hardened plants are most likely to survive. Plant storage on site should be kept short (less than 2 weeks). Planting densely (i.e., on 12 inch centers) will encourage the site to provide habitat and some water quality functions more quickly. A nitrogen-rich slow-release fertilizer may be added to each planting hole prior to closing. Salt marsh cordgrass (*Spartina alterniflora*) is shade intolerant, so it should not be planted in shady areas or, if a mitigation plan involves planting a riparian buffer, trees should not be planted within 20 feet of a salt marsh mitigation area. Additionally, salt marsh cordgrass is recommended to be planted on 18-inch centers, 2 culms per hole. Also, in areas with geese, a goose exclusion system is very important during the plant establishment period.

TABLE 1 - RECOMMENDED COMPENSATORY MITIGATION RATIOS FOR DIRECT PERMANENT IMPACTS TO WETLANDS[13]

Mitigation / Impacts	Restoration[14] (re-establishment)	Creation (establishment)	Rehabilitation[15]	Preservation (protection/ management)
Emergent Wetlands	2:1	3:1	5:1 if hydrology 10:1if vegetation	20:1
Scrub-shrub Wetlands	2:1	3:1	5:1 if hydrology 10:1if vegetation	20:1
Forested Wetlands	3:1	4:1	5:1 if hydrology 10:1if vegetation	20:1
Upland[16]	≥10:1[17]	N/A	project specific	15:1[18]

[13] Includes nontidal and tidal wetlands
[14] Assumes no irreversible change has occurred to the hydrology. If there has been such a change, then the corresponding creation ratio should be used.
[15] 5:1 if hydrology is restored to its natural range (will generally include restoration of natural vegetation community); 10:1 if only the natural vegetation community is restored
[16] This is when upland is used for wetland mitigation, NOT mitigation for upland impacts, which are not regulated.
[17] Only applies if existing condition is pavement or structure AND should complement aquatic functions.
[18] 100' upland buffer recommended for restoration, creation, and rehabilitation sites would be credited here.

TABLE 2 – RECOMMENDED RATIOS FOR COMPENSATORY MITIGATION FOR TEMPORARY AND/OR SECONDARY IMPACTS TO WETLANDS

IMPACT	% OF STANDARD[19] AMOUNT[20]
Temporary fill (e.g., swamp mats, fill over membrane) in forested wetlands; area to revegetate to forest.	15%
Temporary fill in emergent wetlands; area to revert to previous condition.	5%
Temporary fill in scrub-shrub wetlands; area to revert to previous condition.	10%
Permanent conversion of forested wetlands emergent wetlands (with or without temporary fill)	30%
Permanent conversion of forested wetlands to scrub-shrub wetlands (with or without temporary fill)	15%
Removal of forested wetland cover for new corridor	Project specific[21]
Secondary impact edge effects[22]: High level impact zone Remainder of impact zone	 25% 10%

[19] "Standard" refers to amount of compensation that would be recommended under either the Corps' mitigation ratios for permanent direct fill (TABLE 1) or that required in In-lieu fee payments using the standard calculation.
[20] Percentages may be reduced if appropriate project-specific BMPs are incorporated into the project.
[21] This should also take into account fragmentation impacts as part of the secondary impacts.
[22] Total impact zone (feet): emergent – 75, scrub-shrub – 100, forested – 150
High level impact zone (feet): emergent – 25, scrub-shrub – 50, forested – 50

WETLANDS MODULE CHECKLIST

I. Hydrology

1. [ ] Evidence of adequate hydrology to support the desired wetland.
2. [ ] Water source(s)
3. [ ] Evidence of adequate tidal cycle to support the desired wetland.
   a. [ ] elevation of mean high water (MHW).
   b. [ ] elevation of mean low water (MLW).
4. [ ] Salinity

II. Topsoil

1. [ ] Proposed source of topsoil or substrate supplements.
2. [ ] Twelve or more inches of natural or manmade topsoil in all wetland mitigation areas.
3. [ ] Appropriate organic content of topsoil.
4. [ ] Organic content of substrate supplements (if necessary).

III. Planting Plan

1. [ ] Plans use scientific names.
2. [ ] Plant materials are native and indigenous to the area of the site(s); invasive species, nonnative species, and/or cultivars are not proposed for planting or seeding.
3. [ ] Vegetation community types or zones are classified in accordance with Cowardin, et al. (1979) or other similar classification system.
4. [ ] Plan view drawings show proposed locations of planted stock.
5. [ ] More than 50% of the plantings in each zone are species that will become structural determinants for the community type designated for that zone.
6. [ ] Woody stock density is appropriate.
7. [ ] Herbaceous stock density is appropriate.
8. [ ] Seed mix composition is provided.
9. [ ] Representative cross section plans showing vegetative community zones in relation to expected hydrology.
10. [ ] Relocation of plantings allowed when appropriate.
11. [ ] Other - Specific staff recommendations related to planting.

IV. Coarse Woody Material and Other Features

[ ] Appropriate amounts and range of decomposition of coarse woody material are proposed.

WETLANDS MODULE CHECKLIST DIRECTIONS

I. HYDROLOGY

1. The expected seasonal depth, duration, and timing of both inundation and saturation should be described for each of the proposed habitat zones in the mitigation area (particularly related to root zone of the proposed plantings). If shallow monitoring wells are used to develop this rationale, the observations should be correlated to local soil morphologies, rooting depths, water marks or other local evidence of flooding, ponding, or saturation, and reflect rainfall conditions during monitoring.

2. Plan indicates if the water source is groundwater, surface runoff, precipitation, lake and/or stream overflow, tidal, and/or springs and seeps. Provide substantiation (e.g., well data, adjacent wetland conditions, stream gauge data, precipitation data).

3. For tidal wetlands, the expected tidal cycle fluctuations in depth, duration, and timing of both inundation and saturation should be described for each of the proposed habitat zones in the mitigation area (particularly related to root zone of the proposed plantings). Note elevations of mean high water (MHW), mean low water (MLW), and the high tide line, as well as expected storm tide.

4. Salinity range is important for plant and animal species usage and survival.

II. TOPSOIL AND SUBSTRATE

1. Topsoil and other substrate materials for mitigation sites can be a source of invasive species seeds. Provide information on the source and the likelihood that such seeds are in it.

2. Twelve or more inches of natural or manmade topsoil should be used in most wetland mitigation areas. Exceptions might be permanently or semi-permanently inundated or saturated areas and turtle nesting areas. Rationale for less than 12 inches should be provided.

3. Natural topsoil proposed to be used for the creation/restoration/ enhancement of wetlands consists of at least 4-12% organic carbon content (by weight) (or 9-21% organic matter content), **with the percentage specified**. Manmade topsoil used for the creation/restoration/enhancement of wetlands consists of a mixture of equal volumes of organic and mineral materials. This may be accomplished by adding a specific depth of organic material and disking it in to twice that depth. The actual measured organic content of the topsoil used should be provided in the as-built plan submitted with the first monitoring report. Manufactured soil may also have to be tested for contaminants.

4. For tidal wetlands, there is no recommended standard for substrate organic content, but it is recommended to match that of a nearby reference tidal wetland.

III. PLANTING PLAN

1. The use of scientific names ensures that all involved have the correct understanding of the species of plants proposed to be planted or seeded.

2. During the first few years while the designed wetland vegetative zones become established, they are susceptible to colonization and subsequent domination by invasive species. A number of plants are known to be especially troublesome in this regard. The following stipulation shall be included in the mitigation plan, either in the plan view or in the narrative portion of the plan:

➡ To reduce the immediate threat and minimize the long-term potential of degradation, the species included on the "Invasive and Other Unacceptable Plant Species" list in Appendix I of the New England District Mitigation Plan Guidance shall not be included as planting stock in the overall project. Only plant materials native and indigenous to the region shall be used (with the exception of **[specify]**). Species not specified in the mitigation plan shall not be used without prior written approval from the Corps.

3. The Cowardin et al. (1979) classification system is typically used to identify the plant communities proposed. If another system is used, an explanation of terms may be needed.

4. A plan view drawing should show where the various species are proposed to be planted. Since showing each individual plant is neither practical nor realistic, this may be illustrated with areas of uniform species composition and the number of plants or rate of seeding within the polygon. The scale should be in the range of 1"=20' to 1"=100', depending on the size of the site.

5. Although the prevailing hydrology will ultimately influence the type of wetland that will develop, plantings "jump start" the project. When determining species to plant, considerations should include the tendency of some species to volunteer promptly whereas others may take years to move into a site. Determine whether it is preferable to include rapidly establishing species to help prevent invasive species problems or to emphasize planting species unlikely to "volunteer" during the monitoring period.

6. Woody stock should be proposed to be planted in densities not less than 600 trees and shrubs per acre, including at least 400 trees per acre in forested cover types.

7. Where uniform coverage is anticipated, herbaceous stock should be proposed to be planted in densities not less than the equivalent of 3 feet on center for species which spread with underground rhizomes; 2 feet on center for species which form clumps; and salt marsh cordgrass is recommended to be planted on 18-inch centers, 2 culms per hole.

8. The list of species proposed in seed mixes should not include any species in the list of invasives in Appendix I. Similarly, non-native genotypes and cultivars should not be used.

9. Cross-sectional drawings should include identification of vegetative community zones (e.g., forested, shrub swamp, high marsh, low marsh, etc.). This can be combined with the plans required for grading if they are not too complex.

10. The following stipulation shall be included in the mitigation plan, either in the drawings or in the narrative portion of the plan:

➡ During planting, a qualified wetland professional may relocate up to 50 percent of the plants in each community type if as-built site conditions would pose an unreasonable threat to the survival of plantings installed according to the mitigation plan. The plantings shall be relocated to locations with suitable hydrology and soils and where appropriate structural context with other plantings can be maintained.

IV. COARSE WOODY MATERIAL AND OTHER FEATURES

The following language is included in the mitigation plan, either in the drawings or in the narrative portion of the plan:

➡ A supply of dead and dying woody material shall cover at least 4% of the ground throughout the mitigation sites after the completion of construction of the mitigation sites. These materials should not include species shown on the list of invasive species (Appendix I) in the New England District Mitigation Plan Guidance.

APPENDIX E

VERNAL POOL MODULE

VERNAL POOL MODULE DISCUSSION

Determining Compensatory Mitigation for Vernal Pool Impacts:

The following method is the typical way to determine compensatory mitigation for vernal pool impacts. Different methods may be used on a case-by-case basis where specific information (e.g., vernal pool organism migratory pathways) is adequately documented. For direct impacts to the pool itself, compensatory mitigation amounts should be based on the recommended ratios for the wetland type (e.g., forested, scrub-shrub) impacted, found in Table 1, plus the vernal pool impact factor (below). For partial filling of a vernal pool, compensatory mitigation is based on the direct impacts plus the secondary impacts that the partial fill has on the remainder of the pool. Where a project involves partial filling of pools, more detailed information on these pools may be necessary to determine the secondary impacts. For secondary impacts to the vernal pool due to loss or disturbance of the envelope and/or critical habitat, compensatory mitigation is the vernal pool impact factor, which may be calculated from the difference in pre and post project scores for B.1 and B.2 in the Vernal Pool Characterization Form (see Appendix L):

$$\frac{\{[(A.1 + A.4 + A.8.a + A.8.b)pre - (A.1 + A.4 + A.8.a + A.8.b)post]*60\}}{28} + \frac{\{[(B.1 + B.2)pre - (B.1 + B.2)post]*60\}}{32} =$$

vernal pool impact factor

A.1 – points for landscape setting
A.4 – points for aquatic resource type
A.8.a – points for hydroperiod
A.8.b – points for inlet/outlet
(A.1 + A.4 + A.8.a + A.8.b)pre - the total points prior to impacts
(A.1 + A.4 + A.8.a + A.8.b)post - the remaining points after impacts
28 – the maximum points possible for A.1 + A.4 + A.8.a + A.8.b
B.1 – points for the landuse type within the 100-ft vernal pool envelope
B.2 – points for the landuse type within the 100 - 750-ft vernal pool critical terrestrial habitat
(B.1 + B.2)pre – the total points prior to impacts
(B.1 + B.2)post – the remaining points after impacts
32 – the maximum points possible for B.1 + B.2
60 – the multiplier, based on maximum pool values of 60

This method yields the amount of mitigation credit necessary to compensate for vernal pool impacts. Specific ways of meeting those credits may be established by individual In-Lieu Fee programs or on a project-specific basis. Several In-Lieu Fee

programs use 5:1 preservation for direct impacts to vernal pools – i.e., preservation of five vernal pools and their critical terrestrial habitat for the loss of one vernal pool and its critical terrestrial habitat.

Vernal pool creation may be an acceptable form of mitigation for case-specific situations.

MITIGATION FOR VERNAL POOLS

Determining appropriate mitigation for vernal pools requires an understanding of the resource to be impacted and an understanding of the landscape where compensation is proposed to occur. There are several categories of information which are necessary to determine if the mitigation plan is adequate to compensate for the impacts to the resource.

1. Documenting Impacted Vernal Pools:

The seasonal timing and duration of inundation determines whether a pool will provide sufficient habitat for vernal pool-dependent species. Hydroperiod also influences predator composition and abundance. In order to determine appropriate compensation, detailed documentation of the hydroperiod for every pool which may be impacted either directly or indirectly should be provided.

The surrounding forest canopy provides shading, leaf litter, nutrients, and woody material for protection and egg attachment sites within the pool. Removing tree canopy cover can heat up the air, soil, and water, and alter the period of time that water remains in the pool, and influence which species can survive there. In instances where there are primary impacts, additional impacts to the canopy cover may be considered secondary impacts to the vernal pool and should be documented.

2. Mitigation Site Description

Small mammal burrows: Research has shown that amphibians are dependent on small mammal burrows and other terrestrial refuges to prevent desiccation during migration. Documentation of the existence of small mammal populations in the adjacent terrestrial habitat will add to the value of a mitigation plan.

Location: Priority will be given to sites that historically supported vernal pools or have appropriate geology and have appropriate surrounding land use land cover. Agricultural fields, clearcuts, pasture, and other lands lacking impermeable surfaces, but that have historically supported pools and can be reforested, are good options for mitigation, assuming that there is suitable adjacent habitat.

- Resident population: Existing resident population(s) of the target species may improve the likelihood that the mitigation pool(s) will be colonized. Mitigation

sites should be surveyed for evidence of existing source populations and estimates of population size (e.g., egg mass counts) should be documented, if possible.

- Inoculation: Transplantation of vernal pool organisms from sites impacted by the construction project may be warranted. There is limited data on successful methodology for this process. It is important that any inoculation plan is well documented and monitored in order to further understanding on appropriate applications of this technique.

3. Mitigation Type and Goals

Mitigation Type: Created pools often fail to replicate vernal pool hydrology, and may lure breeding amphibians away from more appropriate breeding sites and potentially serve as a population sink. Replacement of natural invertebrate communities is even more difficult. If loss is unavoidable, mitigation should focus on preservation of lands with existing natural vernal pool habitat (off-site or on-site), and restoration or rehabilitation of existing vernal pools and adjacent terrestrial habitat. Any creation projects will require a detailed adaptive management and contingency plan. All creation projects will also require the preservation of appropriate adjacent undeveloped terrestrial habitat.

Wildlife Habitat Function: There are a variety of species which depend on vernal pool habitat to complete one or more of their life-cycle stages. For example, several species of amphibians are dependent on vernal pools to provide breeding habitat to ensure successful reproduction. The ability of a pool to adequately provide safe and productive breeding habitat is dependent on a number of physical and biological characteristics. Although in nature we often find vernal pool amphibians breeding successfully in pools lacking one or more of these features, it is not possible to accurately predict the circumstances under which marginal habitat will effectively provide habitat needs. Therefore, a mitigation plan must aim towards providing vernal pool habitat under the most pristine conditions in order to offer the best opportunity to compensate for lost wildlife habitat functionality.

- The expected hydroperiod for each pool at the mitigation area must be specified. A mitigation plan which includes vernal pool creation should attempt to replicate the hydroperiod of the impacted pool(s) as closely as possible. Groundwater modeling, and water budget calculations, should be used to demonstrate the ability of the site to provide the desired hydrology. If the mitigation plan includes vernal pool creation as part of a larger compensation package, multiple pools with a variety of hydroperiods should be constructed in order to provide the best chance of success. The hydroperiod should also be described for all pool(s) for which enhancement or restoration is proposed. Because hydroperiod can vary annually, multiple years of data should be provided if available.

- Fishless environment: Vernal pools provide breeding habitat for amphibians whose tadpoles and larvae are especially vulnerable to fish predation. Not all vernal pools go dry every year, but they generally have some feature that excludes fish reproduction such as annual drying, low oxygen concentrations in the summer, or shallow conditions that permit winter freezing to the pool bottom. Pools which are truly isolated, having no permanent inlet or outlet, are not susceptible to the establishment of a predatory fish population during ponding. Although there are pools in nature where fish and amphibians coexist, due to the presence of microtopographical barriers, mitigation plans should specify how the pool(s) will maintain a fish-free environment. Signage reminding people not to stock ponds with fish may also be required.

- Microtopography: Natural vernal pool depressions often have varied microtopography throughout the pool basin. The basin of many pools is extremely heterogeneous, offering varied moisture and temperature conditions including the development of hummocks, hardwood leaf litter wells, sphagnum moss, and accumulations of woody material. Creating pool bottoms with microtopography that will enhance plant distribution and invertebrate habitat will add to the functionality of the mitigation.

- Substrate: The substrate of a natural vernal pool bottom often consists of a thick layer of leaves and other decaying organic materials, which provides a valuable food source for vernal pool species. Mitigation projects involving the creation of vernal pools should consider the addition of such a natural substrate. Salvaging organic layers of lost pools may help inoculate the new pools with an invertebrate food base and seeds from native plants. However, be alert to the potential for transplanting invasive species.

- Canopy cover – mitigation: All pools at the mitigation site should have at least 75 percent canopy cover of trees in the area immediately adjacent to the pool (up to 100 feet from the pool edge). The remaining adjacent terrestrial habitat (up to 750 feet from the pool edge, should maintain at least 50 percent canopy cover. Enhancement and restoration projects should consider reforestation of areas without intact canopy; however, it important to realize that increases in woody vegetation immediately adjacent to the pool may alter the hydroperiod due to increased evapotranspiration.

- Critical terrestrial habitat: Habitat for many vernal pool species consists not only of the pool basin, but also of the adjacent terrestrial habitat. Because studies have shown that pool-breeding amphibians can migrate significant distances during the non-breeding season, all land within 750 feet of the pool depression edge should be considered part of the vernal pool habitat unless a study reveals a different configuration.

- In order to provide compensation for the wildlife habitat functions of an impacted vernal pool, adequate terrestrial habitat must be included in the compensation plan. As much as possible of the adjacent terrestrial habitat should be undeveloped, we recommend up to 75%. BMPs should be worked into the management plan when possible.

- Clusters of pools: Clusters of vernal pools that vary in size, hydroperiod, and spatial proximity, provide each resident species with a variety of potential breeding sites. This allows adults to seek out high quality habitat with low densities of predators, provides a safety net in the event that one or more pools become uninhabitable due to disease, and increases the potential for genetic diversity. Protecting existing clusters is encouraged. If creation is proposed, developing a cluster is encouraged.

- Inoculation: Transplantation of vernal pool organisms from sites impacted by the construction project may be warranted. There is limited data on successful methodology for this process. It is important that any inoculation plan is well documented and monitored in order to further understanding on appropriate applications of this technique.

4. Monitoring

Monitoring: Investigators should be familiar with the various types of amphibian monitoring techniques that are available. Specific methods are appropriate for particular species and life stages but not for others. Previous studies of vernal pool establishment attempts have shown limited success in replication of lost habitat functionality. Past projects have also often failed to provide the kind of long-term monitoring data necessary to advance our understanding of successful methodologies for vernal pool establishment and restoration. All vernal pool mitigation plans must include systematic and documented monitoring for hydroperiod and presence of indicator species. Additional guidance documents on some of these methods are listed in the reference section.

- Hydroperiod: Depth, area, and duration of inundation must be recorded at least bi-weekly throughout the entire monitoring period. Pool depth should be monitored in all constructed and reference pools using hydrology staff gauges or some other documented method. The date on which each pool floods and dries should be recorded annually. Pool hydrology should also be documented using hydrographs and photographs.

- Egg mass counts: Egg mass counts provide an index to population size for several indicator species, including wood frogs and spotted salamanders, and are required for all vernal pool mitigation projects. Egg mass counts should be conducted during daylight hours (not within 2.5 hours of sunrise or sunset) on sunny days. Observers should wear polarized sunglasses to reduce glare.

- Other aquatic survey techniques: It is encouraged that egg mass counts be complemented with larval sampling (such as larval dip-netting) to ensure that larvae are developing successfully and leaving the pond. Other methods which may be incorporated into the monitoring plan, depending on the site requirements, include anuran call surveys, road surveys, walking transects, pitfall traps, and dip-netting. For example, anuran call surveys may be used to monitor predatory green frog populations. Dip-netting may be used to document establishment of invertebrate populations. All species observed should be documented including insect taxa and estimates of population size should be included when possible.

- Other: As appropriate, monitoring plans may also include standard water quality measures (e.g., pH, conductivity, nitrogen, phosphorus, BOD, temperature, DOC), contaminant levels, plant species in and around the pool perimeter, and canopy closure. Presence of fish and other predators or invasive species should be documented.

Performance Standard Examples: Measures of success could include the following criteria:

1) Use of the pools by vernal pool indicator species.
2) Maintenance of viable populations of target amphibians.
3) Maintaining a fish-free environment.
4) Maintenance or establishment of closed canopy cover.
5) Hydroperiod replication within project-specific percentage of reference pool.
6) Availability and use of egg mass attachment sites.
7) Establishment of biological viability by comparing specific parameters **[specify]** of constructed pools with those of reference vernal pools from the same immediate areas.

Indicator species found in New England: wood frog (*Lithobates sylvaticus)*, spotted salamander *(Ambystoma maculatum)*, marbled salamander *(A. opacum)*, Jefferson salamander *(A. jeffersonianum)*, blue-spotted salamander *(A. laterale)*, spade-foot toad (*Scaphiopus holbrookii)*, and fairy shrimp (Order: Anostraca).

Facultative species found in New England: include fingernail clams, caddisflies, four-toed salamander, eastern newt, spring peeper, American toad, Fowler's toad, green frog, gray treefrog, spotted turtle, Blanding's turtle, wood turtle, painted turtle, snapping turtle.

Additional guidance on vernal pool conservation, restoration, and creation is included in an excerpt from *Science and Conservation of Vernal Pools in Northeastern North America*, which is posted on our website.

VERNAL POOL MODULE CHECKLIST

I. Vernal Pool Characterization Form

II. Impacted Environment Narrative

1. [ ] Documentation of hydroperiod of pools which will be impacted.
    a. [ ] Timing of seasonal cycle of inundation and drying.
    b. [ ] Duration of inundation and saturation.

III. Target Hydrology

1. [ ] Evidence that mitigation site can provide appropriate hydroperiod to support the desired vernal pool species.
    a. [ ] Documentation of water table and geologic/soil characteristics.
    b. [ ] Water source(s) and water budget calculation.

IV. Target Species Considerations

1. [ ] Description of target species and wildlife observations.
2. [ ] Evidence of resident population(s) of target species at mitigation site.
    a. [ ] Fish-free environment.
3. [ ] Animal transplantation plan is included (if appropriate).

V. Substrate and Physical Characteristics of the Basin

1. [ ] Description and plan drawings of basin shape, depth, area, inlets/outlets.
2. [ ] Microtopography of pool bottom.
    a. [ ] Proposed source of material for confining layer (if needed).
    b. [ ] Leaves and other decaying organic materials for pool substrate.
3. [ ] Egg attachment sites and woody material.

VI. Terrestrial Habitat and Landscape Level Characteristics

1. [ ] Description of landscape surrounding vernal pool.
    a. [ ] Percent developed and other physical barriers.
    b. [ ] Percent forested.
    c. [ ] Location(s) of and proximity to other vernal pools.
    d. [ ] Presence of small mammal burrows and other terrestrial refuges.
2. [ ] Preservation of adjacent terrestrial habitat.

VII. Planting Plan

1. [ ] Plans use scientific names.
2. [ ] Plant materials are native and indigenous to the area of the site(s); invasive species, nonnative species, and/or cultivars are not proposed for planting or seeding.
3. [ ] Plan view drawings show proposed locations of planted stock.
4. [ ] Plantings for shading.
5. [ ] Plantings for egg mass attachment.

6. [ ] Seed mix composition is provided.
7. [ ] Other - Specific staff recommendations related to planting.

VIII. Monitoring

1. [ ] The monitoring methodology is specified.
    a. [ ] Monitoring period.
    b. [ ] Timing of monitoring visits.
    c. [ ] Egg mass counts.
    d. [ ] Larval sampling (such as larval dip-netting).
    e. [ ] Hydroperiod
2. [ ] Appropriate language included.
3. [ ] Information on state/local vernal pool registration or certification program.

IX. Contingency

VERNAL POOL MODULE CHECKLIST DIRECTIONS

I. VERNAL POOL CHARACTERIZATION FORM

1. See Appendix L.

II. IMPACTED ENVIRONMENT NARRATIVE

1. Provide documentation of the hydroperiod of all vernal pools which may be impacted, either directly or indirectly. Hydroperiod documentation must include information about both the timing of the inundation/drying cycle and the duration of inundation. (e.g. Pool is flooded completely as of [date of first visit], begins drying around [date] and is completely dry by [date], for a hydroperiod of [X] weeks). Observations should be made and documented during at least one entire breeding season in advance of any construction activity. See glossary in Appendix A.

III. TARGET HYDROLOGY

1. If vernal pool creation or restoration is included as part of the mitigation plan, provide evidence that adequate hydrology exists or will be provided to support the hydroperiod requirements of the target species (See Section II above). In the case of vernal pool rehabilitation or preservation, provide documentation of the hydroperiod of the existing pools, as described above in Section I.1.

2a. Describe the subsurface geologic characteristics of the site including parent material type and water table characteristics.

2b. See Section I.2 in Wetlands Module. Water budget calculations (showing all sources of hydrologic inputs to and outputs from the system) should be provided to ensure that desired degree of seasonal drying will occur.

IV. TARGET SPECIES CONSIDERATIONS

1. For mitigation plans that include preservation of existing vernal pools, wildlife observations should be documented following the same format as Section C of the Vernal Pool Characterization Form. For mitigation plans that include creation or restoration of vernal pools, a narrative of the target species composition (based on a reference pool) should be included.

2. Mitigation plans that include creation or restoration of pools must survey the proposed mitigation site and adjacent land for evidence that there is an existing resident population of the target species. Provide documentation of presence and estimated abundance if possible.

2a. Mitigation plans should specify how the pool(s) will maintain a fish-free environment, especially in cases where preservation or restoration pools may not be completely isolated hydrologically. Signage reminding people not to stock ponds with fish may also be required.

3. Under certain circumstances, such as the absence of an existing resident population of target species, it may be appropriate to inoculate mitigation pools with egg masses from existing pools. A detailed plan must include the source and location of the inoculum, storage and transportation, timing of activity, and provisions to minimize disturbance to the remaining egg mass population.

V. SUBSTRATE AND PHYSICAL CHARACTERISTICS

1. Where vernal pools are to be created or restored, include detailed descriptions and plan drawings of the parameters: basin shape, slope, depth, and area.

2a. Mitigation projects involving the creation or restoration of vernal pools should include detailed plans to create a heterogeneous pool bottom that resembles the microtopography of a reference pool. If a confining layer is necessary, the source of material and construction methodology should be described.

2b. Appropriate amounts of leaf litter and other decaying organic materials are needed to provide adequate habitat in the pool(s). Source and location should be specified to ensure that invasives are not introduced to the site inadvertently.

3. Egg attachment sites should consist of a combination of shrubs, persistent emergent vegetation and coarse woody material. Describe the amounts and range of decomposition of coarse woody material proposed for pool structure and egg mass attachment sites. Source and location should be specified. See Planting Plan (section VII) below.

VI. TERRESTRIAL HABITAT AND LANDSCAPE LEVEL CHARACTERISTICS

1. A detailed description of the adjacent terrestrial habitat must be included in the mitigation plan and any enhancements proposed should be described. When feasible this description should encompass all land within 750 feet of the pool depression edge.

1a. Include as much information as possible about the percentage of surrounding landscape which is already developed and the types of development. Also include information about the presence of existing physical barriers to movement (e.g., roadways, perennial water courses).

1b. Describe the percentage of the surrounding landscape which consists of intact forest canopy (both wetland and upland), keeping in mind the BMPs for canopy cover described above.

1c. Describe the presence of other vernal pools (location and proximity) including information about other pools with are proposed to be created or restored.

1d. Adjacent terrestrial habitat should be surveyed for the presence of small mammal burrows and other terrestrial refuges which are often used by vernal pool amphibians to prevent desiccation during migration. Documented evidence that multiple such features exist in the surrounding landscape will enhance the value of the mitigation project

2. An acceptable mitigation plan must include provisions for preservation (conservation easement) in perpetuity of adjacent terrestrial habitat. Most vernal pool mitigation projects will require preservation of all undeveloped land within 750' of the pool depression edge.

VII. PLANTING PLAN

1. – 3. See III. 1. – 3. in Wetlands Module (Appendix D).

4. Shade plants are an important part of vernal pool habitat. Describe any changes to existing shade species and any proposed plantings to generate shade. In the case of preservation and enhancement, it important to realize that increases in woody vegetation immediately adjacent to the pool may alter the hydroperiod due to changes in evapotranspiration, make sure to consider this during the development of planting plans.

5. There should be adequate places for attachment of egg masses from vernal pool species. Typically, these are the woody stems of shrubs, persistent emergent vegetation, or woody material. Explain and describe proposed attachment provisions and specify source of material to prevent introduction of invasives.

6. See III. 8. in Wetlands Module (Appendix D).

VIII. MONITORING

1. Monitoring methodology should be specified and described in detail. All monitoring protocols must include egg mass counts and larval sampling. Other acceptable methodologies include anuran call surveys, dip-netting, and nocturnal road surveys. The language below is designed for spring-breeding species. If monitoring is necessary for fall-breeding species such as blue-spotted salamanders, the wording should be modified appropriately.

MONITORING

Pool is monitored for obligate and facultative vernal pool species weekly for four weeks from the beginning of the vernal pool activity in the spring (the actual date will vary throughout New England), then biweekly until the end of September or until the pool is dry, whichever comes first, for the entire monitoring period (minimum of 5 years). The period of monitoring is specified for each monitoring year. These data should identify frog species, salamander genera, and the presence/absence of fairy shrimp. Macroinvertebrates can be identified down to the Order.

In addition, photographs of the pool(s) taken monthly during the pool monitoring period (March/April-September) from a set location(s) will be included. Photographs will also include panoramas of surrounding habitat.

Other data required: pH and temperature of water at beginning and end of each monitoring cycle; pool depth at deepest point(s) (or state if >3') to nearest inch or centimeter; substrate of pool(s) (dead leaves, herbaceous vegetation, bare soil—organic or mineral, etc.); plant species noted in and around the perimeter of the pool(s)

If the state has a vernal pool register or certification program, the pool(s) is registered and/or certified prior to the final monitoring report submission.

APPENDIX F

SUBMERGED AQUATIC VEGETATION (SAV) MODULE

SAV MODULE DISCUSSION

Submerged Aquatic Vegetation:

SAV habitats are estuarine and coastal habitats dominated by one of several seagrass species. Typical species include eelgrass (*Zostera marina*), widgeon grass (*Ruppia maritima*), and various *Potamageton* sp. which are found in brackish, salt marsh, and coastal environments in New England.

SAV habitats have many beneficial properties. These include providing refuge, nursery areas, and food sources for a number of coastal species, and the ability to stabilize these species by reducing turbidity and the remobilization of sediments.

Geographical Location

The geographical location and physical structure of any given site can be a major determinant for the establishment and persistence of SAV habitat over time. Geological and physical factors include sediment bed and grain size structure, water temperature and salinity regimes, water depth, and wave exposure.

Environmental Factors

Environmental factors influencing the persistence of SAV are numerous and have been elaborated in a number of studies. Although many factors influence SAV survival, those of major importance are grazing pressure from herbivores, disturbance of rhizomes by foraging animals, and growth of epibionts on leaf blades.

Watershed Activities and Development

Watershed activities and the degree of development within an embayment can set the limits for the persistence and degree of impairment for both previously occurring and restored SAV habitat. Physical disturbance from maritime activities and nitrogen loading and turbidity from contributing watersheds can contribute to SAV habitat degradation and loss (Short et al. 2012). Activities that cause physical disturbance of SAV include dredging, pier and marine facility construction, and boat traffic. Boat traffic effects have been the subject of recent studies centering on the effects of prop wash, boat wake disturbance, and the sustained scouring action of boat moorings on SAV habitats.

Mitigation Approaches

Although *Zostera* dominates SAV mitigation efforts in New England, the sometimes ephemeral nature of local eelgrass beds and the water quality and levels of physical disturbance can greatly challenge the success of mitigation projects. A body of work is centered on improving this success rate. *Ruppia* mitigation has its own challenges (refs), but such projects are uncommon in New England. *Ruppia's* brackish habitat tends to be more distant from the seaward end of drainage basins, navigation channels, large maritime projects, and other elements of heavy coastal developments.

For the purposes of clarity and utility, the rest of this section will center on eelgrass habitat mitigation.

Mitigation Types

There are three main in-kind types of eelgrass mitigation commonly performed in New England: eelgrass habitat restoration through planting of eelgrass propagules, deployment of specialized (conservation) moorings in impacted eelgrass beds, and the development of adaptive management techniques aimed at increasing system-wide watershed water quality.

Eelgrass Habitat Restoration

Long-term sustainability of conditions suitable for SAV is key to successful eelgrass mitigation. Success is largely a factor of the site selection, timing, and method used.

Low success rates in the past have been primarily attributed to poor site selection. Wherever possible, select sites where eelgrass previously existed and/or where potentially optimum environmental conditions for eelgrass currently exist. The environmental factors evaluated should include light attenuation, exposure and wave energy regimes, substrate quality, historical distribution, temperature, salinity, epibiont presence, incidence of herbivory, nutrient loading and resident nitrogen levels, the condition of subaqueous soils, and some discussion of the likelihood of wasting disease.

A number of research efforts have been conducted to quantify and standardize the establishment and monitoring of eelgrass mitigation projects. The applicant is urged to consult one of the guidance documents to get practical knowledge for designing successful eelgrass mitigation projects. An example of a comprehensive and useful effort can be seen in the guidance documents promulgated by the Massachusetts Division of Marine Fisheries (Evans and Leschen, 2010).

There are a number of steps to initiating an eelgrass restoration project. These are:

- Find areas with optimum growth conditions using Eelgrass Site Selection (ESS) software and environmental criteria from previously chosen preliminary test sites
- Characterize the site using the ESS software
- Create a 100-meter buffer around existing beds to minimize impacts from mitigation work, provide the opportunity for the beds to expand naturally, and to simplify post-construction monitoring
- Choose a preferred mitigation site from among the candidate test sites
- Select a minimum of three vegetated reference sites
- Find a donor site (the preferred donor source would be shoots harvested from the impacted site)
- Harvest eelgrass shoots from donor site
- Replant shoots or, alternatively, broadcast seeds (reportedly this method has a low success rate in New England)
- Monitor establishment and success rate using appropriate indices at both the mitigation and all of the reference sites

Each of these steps is designed to maximize the probable success of the proposed area of eelgrass habitat. The logistics of harvesting shoots or collecting seeds, then transplanting or seeding mitigation areas must be carefully developed beforehand.

When planning eelgrass mitigation projects, it is vital to choose locations with optimum environmental conditions before the project is started. A number of test sites should be selected and subjected to rigorous evaluation before a final mitigation site is selected. To this end, eelgrass mitigation projects usually employ the ESS software, an example of which is described in Short et al. (2002). This software uses long-term, tidally averaged environmental data to rate potential mitigation sites.

In order to have long-term sustainability, sites must be protected from degradation. Applicants should consider both current and expected future environmental conditions (including effects of any proposed manipulations) and evaluate long-term trends in water quality, sediment transport, maritime activities in the vicinity, contributing water resources, and overall watershed functional goals before choosing a mitigation site. This is extremely critical in watersheds that are rapidly urbanizing; changing watershed development rates can modify runoff and nutrient loading profiles substantially, with associated changes in sediment transport, flooding frequency, and water quality. Water quality problems, such as increased nutrient loading and sedimentation, lead to degraded eelgrass habitat in the form of lower light attenuation, increased epiphytic growth on the eelgrass shoots and increased water column turbidity.

Water quality is critical. Every effort must be made to maintain or increase water quality long term. More importantly, applicants must plan for long-term survival by placing mitigation in areas that will not be severely impacted by clearly predictable

water quality degradation factors. During the first few years while the designed eelgrass beds become established, they are susceptible to degraded water quality, herbivory, temperature extremes and physical disturbance. Buffers are particularly important to insure that changing conditions are ameliorated, especially in watersheds and embayments that have been, or are in the process of being, heavily developed. In addition, because eelgrass habitats are so dynamic, adequate buffers and unvegetated subtidal areas are vital to allowing for eelgrass beds to expand and/or decrease in size and function and migrate within the embayment, particularly in coastal areas under natural and/or man-made pressures.

Eelgrass planting methods can contribute greatly to potential success rates. Care should be taken to select a technique that is most likely to succeed in a particular location. A detailed discussion of planting methods (rhizomes, seedcasting, Transplanting Eelgrass Remotely with Frame Systems (TERFS), etc.) along with proposed planting densities and grid arrays should be provided. Site bathymetry maps should also be included. Test plantings may be necessary to fully evaluate proposed site alternatives.

Conservation moorings

Conservation moorings are a new anchoring technology that replaces the older, more prevalent chain and anchor mooring widely used to date. The new moorings use an elastic and buoyant line often attached to a helical screw anchor. This arrangement minimizes the effect of heavy chains that drag along the bottom adjacent to the anchor. The chains scour circular scars into the eelgrass habitat denuding the bottom of rhizomes and leaf blades, while increasing turbidity and remobilizing silt. Over time, a concentration of chain moorings can clear a significant amount of eelgrass from an embayment. A conservation mooring operates by suspending the anchor line above the bottom throughout the tidal cycle, preventing chain scour and allowing eelgrass to re-establish the area within the scour marks. The amount of impacted habitat that is restored is quite variable, because the area that was denuded can vary significantly from location to location. In some cases, restoration can be aided by planting eelgrass propagules in the scour mark.

Conservation moorings can be a cost-effective option for SAV mitigation, especially as an alternative when other methods that have been attempted meet with limited success. However, there are a number of caveats for this option. The success rate, measured by replacement of a scour mark with eelgrass has not been consistently characterized. In fact, if eelgrass does grow into the scour, the difference in elevation and depositional environment can result in a degraded eelgrass stand compared to adjacent areas.

In addition, the area scoured and the underlying substrate may differ significantly from adjoining areas and contribute to a different restoration trajectory. Since the Corps may accept the installation of conservation moorings as compensatory mitigation for a project, the installation phase of these moorings should be carefully

evaluated. Factors that should be emphasized are the square footage of each scour mark, an inventory system for recording the precise location, mooring technology, designation of an experienced contractor and the proposed maintenance schedule of these more complicated systems. Contact the Corps for Installation of Conservation Mooring System Record forms if needed.

Adaptive watershed management

This method encompasses a range of adaptive measures taken to improve water quality, enhance environmental conditions, and alter maritime activities in an effort to create conditions more conducive to SAV habitat. These can be stand-alone projects, capstone initiatives, or as a part of an in lieu fee funded project. They could take the form of reducing nitrogen inputs into coastal waters, encouraging adaptive management of storm water systems, and runoff collection structures to improve impaired environmental conditions. The major caveat is that this approach, while laudable, has little empirical support for a quantitative relationship between management approaches for watershed improvements and an areal increase in specific SAV habitat. This lack of quantitative analysis limits its present applicability for compensatory mitigation.

Recommended compensatory mitigation ratios are included in Table 3 below.

TABLE 3 - RECOMMENDED COMPENSATORY MITIGATION RATIOS FOR DIRECT PERMANENT IMPACTS TO SUBMERGED AQUATIC VEGETATION

Mitigation **Impacts**	**Restoration (re-establishment)**	**Creation (establishment)**	**Rehabilitation**	**Preservation (protection/ management)**
Vegetation re-planting	5:1	project specific[23]	project specific[24]	N/A
Conservation mooring installation	>5:1	N/A	>5:1	N/A
Water quality improvements to watershed	project specific	N/A	project specific	project specific

[23] Rare cases, e.g., removal of uplands, old fill, etc.
[24] E.g., remove pollutant source such as an outfall, remove moorings.

SUBMERGED AQUATIC VEGETATION MODULE CHECKLIST

I. Hydrology

1. [ ] Evidence of appropriate hydrology to support the desired SAV.
   a. [ ] Depth at mean low water.
   b. [ ] Depth at mean high water.
2. [ ] Exposure and wave energy regimes.

II. Other Environmental Factors

1. [ ] Appropriate water quality.
   a. [ ] Light attenuation.
   b. [ ] Quantitative evaluation of nitrogen-loading regimes.
   c. [ ] Temperature.
   d. [ ] Salinity.
2. [ ] Epibiont presence.
3. [ ] Incidence of herbivory.
4. [ ] Likelihood of wasting disease.
5. [ ] Adequate buffers and unvegetated subtidal areas (to allow for eelgrass beds to expand and/or decrease in size and function and migrate within the embayment).
6. [ ] Results from ESS software.

III. Plans

1. [ ] Planting.
2. [ ] Location of boat access.

IV. Environmental Conditions

1. [ ] Substrate material and quality.
2. [ ] Historical distribution of SAV.

V. Planting Plan

1. [ ] Plans use scientific names.
2. [ ] Planting methods.
3. [ ] Location of donor beds.
4. [ ] Planting densities and grid arrays.
5. [ ] Other - Specific staff recommendations related to planting.

VI. For Conservation Moorings

1. Extent of scoured SAV habitat
2. Average scour size
3. Installation Plan
4. Point of contact, inventory (see attached) and maintenance plan
5. Resume of installation contractor
6. SAV planting schedule within scours (project-specific)
7. Example of inventory sheet

VII. Monitoring

[ ] Appropriate monitoring language is included.

VIII. Contingency

SUBMERGED AQUATIC VEGETATION MODULE CHECKLIST DIRECTIONS

I. Hydrology

II. Other Environmental Factors

6. Use of Eelgrass Site Selection software is strongly recommended for all eelgrass mitigation and is required for mitigation projects over 0.25 acre in size. Results from the software, along with other environmental data should be submitted to the Corps for review and approval before the preliminary test sites are chosen.

III. Plans

1. A plan view drawing clearly delineating where the eelgrass is proposed to be planted. Since showing each individual plant is neither practical nor realistic, this may be illustrated with the number of plants or rate of seeding within the polygon. The scale should be in the range of 1"=20' to 1"=100', depending on the size of the site.

2. The drawings should show the boat access for maintenance and monitoring.

IV. Environmental Conditions

1. Substrate must be suitable for development and maintenance of SAV. The site has the environmental conditions, as demonstrated with data gleaned from archival sources or collected on site, to support the designed subtidal habitat.

2. Identify historical distribution of SAV in the project area.

V. Planting Plan

2. Whole-plant planting and/or seeding are generally appropriate for a mitigation site, as determined through consultation with the Corps. Several eelgrass planting methods have been developed over time (for more information, see information from the National Oceanic and Atmospheric Administration). When any of the planting methods are used, planting techniques should employ a checkerboard pattern with the shoot density in each quadrat to be 50 per quarter-acre. Among those most commonly used are:

The **horizontal rhizome** technique is commonly employed to restore eelgrass habitat (Davis and Short, 1997). In this approach, rhizomes are harvested from a donor site. After harvesting the shoots, they are gathered into bundles of 50 and transported by cooler to the transplant site. Eelgrass shoots should be installed at a minimum of the initial density of the impacted bed. Two rhizomes are tied together so that their

shoots are on opposite ends of the bundle. Then, the whole bundle is manually planted in the substrate by divers. The horizontal rhizome method is labor-intensive and works best when no more than four shoots are bundled together. A variety of this technique involves tying large bundles of shoots together and planting them all at once. Anecdotal evidence indicates favourable success rates employing this method (S. Tuxbury, personal communication).

Broadcasting of eelgrass seed in Chincoteague Bay has met with some success. Although the technique is much less labor-intensive, the sprouting seedlings are very sensitive to environmental conditions at the bottom as well as herbivory and bioturbation. Low overall success rates in New England were reported by Orth et al. 2009 and Orth et al. 2008. However, Leschen et al. 2009 reported good success rates in Boston Harbor.

TERFS (or Transplanting Eelgrass Remotely with Frame Systems) is a rigid frame grid made of wire and bricks (Burdick and Short, 2002). Two rhizomes are tied to each of the intersections of the grid with biodegradable material, and then the entire frame is deployed on the bottom. Frames should be planted 2-3 meters apart. The frame is then removed after approximately a month when the rhizomes have established themselves in the substrate. See the University of New Hampshire's website for further information.

3. Native planting stock from the immediate vicinity of the project is ideal. Whenever possible, plants should be salvaged from eelgrass beds destined for removal or impact from the original project. Other donor beds should be carefully chosen. Care must be taken not to cause negative impacts to the donor bed by harvesting. Overharvesting of donor beds can damage physical structure and encourage the invasion of green crabs into the mitigation site. For this reason donor beds not located in the impact area must be specified in the mitigation plan.

VI. Monitoring

The following language should be included in the narrative portion of the mitigation plan (this replaces the standard monitoring language in the Overall Mitigation Plan Guidance):

MONITORING

Monitoring should begin one month after transplanting or seeding and again at semi-annual intervals and include:

1. Calculation of the percentage of planting units (clumps or horizontal rhizomes) that survived vs. the total planted.

2. Shoot density (# of shoots vs. baseline shoot density). Shoot density should be measured *in situ* within the 0.0625 m^2 quadrats for each planting grid and within the reference area.

3. Percent cover.

4. Canopy height (80% of the average of the tallest leaves).

5. Presence and number of reproductive shoots.

6. Areal extent of the bed (determined as the total area of continuous eelgrass and patches at the project site, excluding grass that is 100m away (Short et al., 2006, Lockwood et al., 1991). The extent of the bed can be mapped using a drop camera or divers recording GPS readings at several points along the edges of the continuous bed and at the last shoot (Short et al., 2006 and Short et al., 2001).

Performance Standards

[Specific performance standards for the project should be included here. See list of examples below.]

Performance Standard Examples

THESE ARE ONLY EXAMPLES. SPECIFIC PERFORMANCE STANDARDS SHOULD BE DEVELOPED FOR EACH PROJECT.

Estimating the success (or degradation) of eelgrass mitigation projects requires the evaluation of a number of habitat functions and productivity measures. These include estimates of shoot density, areal extent, epibiont density, and water quality. Performance standards are project-specific, but some examples are included here, each of the criteria to be met within a minimum of five years for the project to be determined successful.

1) The mitigation site had at least 75% survival of shoots after one year.

2) Shoot densities are no less than 50% of the target densities in the first two growing seasons, followed by no less than 75% in the third, fourth, and fifth years of monitoring.

3) Unless otherwise specified in the mitigation plans, the plant/shoot density is no less than that observed at the impacted site. The density measurement is the greater of the impacted site and the reference site. This can be assessed using either total inventory or quadrat sampling methods, depending upon the size and complexity of the site.

4) Transplants demonstrate at least 25% expansion of areal coverage within 1 year of transplanting. After the first 3 years the parameters are on a trajectory approaching reference levels.

5) Chosen indicators of function (e.g., eelgrass biomass, density) in the transplanted and reference eelgrass beds are compared and a bench mark of success calculated from the reference site data as follows:

- Success Criteria (SC) =100*(mean of all reference sites – 1 standard deviation/mean of all reference sites).
- Measured indicators at the restoration and reference sites are then compared in the following equation:
- Success Ratio (SR) = 100*(mean of one restoration site/ mean of selected reference sites).

When the SR for a given indicator equals or exceeds the SC, the restoration is considered successful for that indicator.

Monitoring Report Requirements

Additional items for inclusion:

Project Overview

- Highlighted summary of problems which need immediate attention (e.g., problems with substrate characteristics, severe invasive species intrusion, serious erosion, major losses from herbivory, disease, etc.). This should be at the beginning of the report and highlighted in the project overview and in the self-certification form.

Requirements

- A copy of this permit's mitigation special conditions and summary of the mitigation goals.

Summary Data

- Address performance standards achievement and/or measures to attain the standards.

- Describe the monitoring inspections, and provide their dates, that occurred since the last report.

- Quantify tidal ranges, measured seasonally, in physical parameters of substrates.

- Quantify water clarity, nitrogen loading, and salinity.

- Presence of crab populations as well as the presence and density of epibionts (quantified by percent leaf shoot cover) must be estimated.

- Concisely describe remedial actions done during the monitoring year to meet the performance standards – actions such as removing debris, replanting, controlling herbivores (with biological, herbicidal, or mechanical methods), deploying exclosures, adjusting site bathymetry, etc.

- Report the status of all disturbance barriers or other techniques for minimizing effects of bottom disturbance on the compensation site(s). Are they in place and functioning? If temporary measures are no longer needed, have they been removed?

- Give visual estimates of percent vegetative cover for each mitigation site using shoot densities collected in a quadrat sampling plan.

- What fish and wildlife use the site(s) and what do they use it for (nesting, feeding, shelter, etc.)?

- Describe the general health and vigor of the surviving plants, the prognosis for their future survival, and a diagnosis of the cause(s) of morbidity or mortality.

Conclusions

- What remedial measures are recommended to achieve or maintain achievement of the performance standards and otherwise improve the extent to which the mitigation site(s) replace the functions and values lost because of project impacts?

Monitoring Report Appendices

Appendix A – An as-built/as-planted plan showing bathymetry to 1-foot contours and the location and extent of the designed eelgrass beds. Within each community type, the plan shall show the species planted—but it is not necessary to illustrate the precise location of each individual plant. This document should be included in the first monitoring report and updated if there is grading or additional plantings required in subsequent years.

Appendix B – A percent cover of SAV by species. The volunteer species list should, at a minimum, include those that cover at least 5% of the cover.

Appendix C – Video documentation of each mitigation site and representative photos of transects from each mitigation site taken from the same locations for each monitoring event. This documentation will consist of video transect monitoring along fixed lines to be done during the peak growing season at a time to be the same each year. Photos should be dated and clearly labelled with the direction from which the photo was taken. The photo sites must also be identified on the appropriate maps. In addition, in-water surveys will be conducted that include shoot density, % cover, epibiont % cover, crabs, and light extinction levels.

VII. Contingency

If the beds are not expanding at a desired rate, and success as measured by the performance standards is not met, then a contingency plan should be considered. Describe the procedures to be followed should unforeseen site conditions or circumstances prevent the site from developing as intended. Examples of such situations include ship wrecks, oil spills, weather conditions (drought, heat, etc.), bottom currents, etc.

Alternatives to creation of eelgrass habitat may only be considered as a last resort if the constructed beds fail and/or if no alternate appropriate site can be found (determined after consultation with the Corps). The Corps will have the final say as to whether an alternative shall be used by a permittee in part or in full to meet mitigation requirements. This will be evaluated each year after reviewing results of the monitoring report

There are a number of alternative compensatory mitigation types. These may include:

- Improvements in watershed development activities, such as establishing sediment input management plans.
- Improvement in marine-related technologies, such as alternative techniques to minimize bottom scouring in eelgrass beds.
- Improvement of sewage technologies, such as increasing efficiency of nutrient removal technologies in a sewage system or installing sewer lines to a non-sewered development adjacent to eelgrass habitat.
- Where state policies allow, contribution to an in lieu fee program, provided program funds of at least the amount of the payment are used for eelgrass mitigation.

In all cases except the fourth, these options are not preferred alternatives because of the inability to quantify their potential to enhance or create eelgrass habitat. For this reason, the Corps will require a larger mitigation ratio in these cases.

APPENDIX G

STREAM MODULE

STREAM MODULE DISCUSSION

Overview:

Streams are a distinctly unique water resource within the context of the Corps' Regulatory purview. They are complex and ever evolving systems that can provide various functions and services depending on the surrounding landscape. Most importantly, due to the connected nature of stream systems, impacts to one reach in a watershed can affect other reaches within the system.

This module can be applied when determining the appropriate amount of compensatory mitigation for stream impacts. Impact "Debits" and mitigation "Credits" can be quantified using Tables 4 and 5, respectively, and are based on the stream condition determined using the Stream Visual Assessment Protocol Version 2 (SVAP2) developed by NRCS (National Biology Handbook, Part 614). The SVAP2 provides a basic evaluation of stream health and does not require extensive training or knowledge of aquatic biology. Best Professional Judgment and coordination with the Corps should be used when the SVAPs is not applicable. As with other modules, this is guidance and can be applied on a case-by-case basis using best professional judgment in response to site-specific conditions.

Key Considerations:

Stream Order

Streams are structured hierarchically from upstream to downstream (Figure 1). The aquatic animals and plants in streams are adapted to the natural hydrological regime (timing, magnitude, and duration of high and low volume flows). Headwaters, including ephemeral and intermittent streams, are at the top of the hierarchy because impacts to these reaches have the potential to impact the entire system. They also constitute the majority of stream length in any given drainage system. Headwater streams provide critical habitat for resident and migratory fish species. Higher order, perennial streams (fourth order and above) are known for higher productivity and valuable fish habitat. Perennial streams provide aquatic organism habitat year round as opposed to ephemeral headwater streams that typically support few aquatic organisms. Maintaining unobstructed access to these habitats is essential to preserving the natural biodiversity of the system.

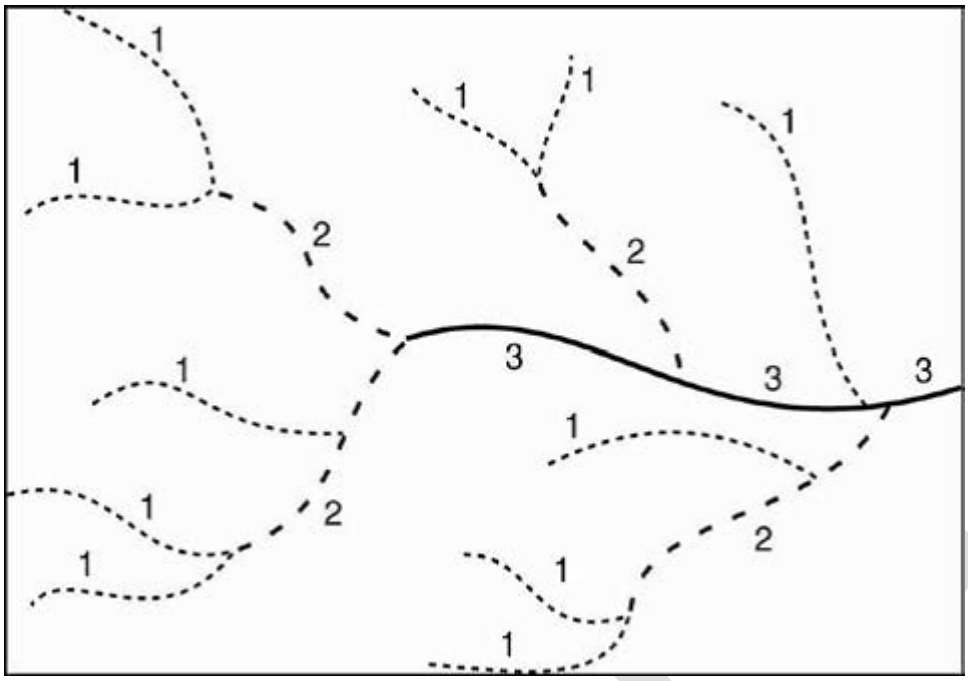

Figure 1. Stream Order (from Strahler)

Stream Type

All streams respond differently to disturbances. For example, stream reaches with steep slopes, containing bedrock or large boulders within confined channels are typically less prone to disturbance from changes in fine sediment supply and hydrology compared to reaches of flatter slope with finer textured substrates within wider channel valleys. These channels are much harder to restore than other types because they are such high-energy systems. Stream reaches that are plane-bed, riffle-pool, braided, or dune and ripple are typically better at retaining nutrients and sediment. Differences in physical composition also result in differing biogeochemistry, nutrient recycling, habitat, and food web functions. Consequently, it is important to document the physical characteristics of the streams since, when mitigation is required, it will help determine if similar functions are restored or enhanced.

Mitigation Site Selection

There are many variables influencing the physical, chemical and biological composition of stream systems. All of these variables should be considered to the extent practicable when planning a mitigation project and include, but are not limited to, geography, bed material, fluvial geomorphology, and position within the surrounding landscape.

Floodplains

Floodplains are important in modulating stream flow, supplying substrate for biogeochemical transformations (including denitrification), supplying and receiving coarse woody material, and providing habitat for diverse aquatic and terrestrial organisms. Overbank flow and channel migrations across the belt width create and maintain a diverse array of habitat types, including secondary channels, oxbow ponds, marshes, vernal pools, and forested wetlands.

Riparian Buffers

Vegetated riparian buffers may help regulate water temperatures, intercept pollutants and sediment, and provide detritus which is a vital component of aquatic food webs. Buffers also provide migration corridors and can provide critical habitat for many non-aquatic species associated with stream habitat.

Changes to riparian vegetation can have long-term impacts on Coarse Woody Material (CWM) recruitment. Replacement of riparian vegetation with riprap or other hard structures along stream banks can impact water temperature, water quality, wildlife and fish habitat, stream stability and overall functionality. Such alterations can encourage recruitment of invasive species.

In-Stream Structures: Natural

CWM and boulders are stream features that retain materials such as sediment, organic matter, and nutrients, especially in small and moderate sized streams. As detritus decomposes, it supplies dissolved organic carbon (DOC) used in denitrification and particulate organic carbon (POC) used by shredder organisms. These natural in-stream structures create and maintain complex stream habitat features such as riffles, pools, and other resting and hiding habitat for aquatic biota. Channelization and/or removal of large, in-stream material can alter hydrologic flow characteristics as well as limit sediment and nutrient retention.

Many of the processes important in a natural high functioning system would be impaired by static structures so this should be taken into consideration in the stream mitigation design. Also, smaller diameter and length logs will be highly mobile in larger systems, and of less habitat value.

In-Stream Structures: Engineered

Vanes, J-hooks, weirs, and a variety of other structures have been installed to improve fish habitat, and direct flows away from banks and structures, etc.

Dam Removals

Potential impacts to wetlands associated with dam removals must be considered on a case-by-case basis. Factors to consider include the likelihood of establishment of new wetlands along the new stream channel, the loss of large expanses of wetland with little likelihood of any establishment of new wetlands, or the establishment of floodplain wetlands where there were few wetlands in and around the impoundment. These factors should be balanced with the restoration of stream function as described in the performance standards below.

Defining Goals, Objectives, and Performance Standards:

It is important for stream mitigation projects to have clearly defined goals. Specific performance standards will be integral in determining the level of success or failure of the mitigation site. Goals will typically be targeted towards achieving some level of physical, chemical, and/or biological improvement within the stream system. Below is a partial list of stream mitigation projects by type and the functions they may restore or enhance.

Removal of Dams or culverts effectively functioning as dams

- Restore native ecosystem productivity and biodiversity
- Increase sediment, nutrient, and wood transport
- Restore natural hydrologic regime
- Improve water quality and thermal regime
- Improve riparian functions
- Restore migration and movement of aquatic biota (fish, invertebrates, etc.)
- Restore availability of upstream aquatic habitats

Existing culvert upgrades (to meet Stream Crossing Standards) or removal

- Increase/restore native ecosystem productivity and biodiversity
- Increase/restore sediment, nutrient, and wood transport
- Restore natural hydrologic regime
- Improve migration and movement of aquatic biota
- Increase/restore availability of upstream aquatic habitats

Restoration of riparian and floodplain vegetation

- Increase native ecosystem productivity and biodiversity
- Increase habitat complexity of stream ecosystem
- Increase sediment and nutrient retention in riparian areas and floodplains
- Improve thermal regimes, e.g., shading by riparian vegetation
- Improve water quality

Re-establish connections to floodplains and side channels

- Increase native ecosystem productivity and biodiversity
- Increase habitat complexity of stream ecosystem
- Increase sediment and nutrient retention in riparian areas and floodplain
- Improve access to refuge and reproductive habitat for organisms
- Improve thermal regimes, e.g., shading by riparian vegetation
- Improve water quality
- Reduce flashiness
- Restoration of natural hydrologic regime

Remove riprap and concrete banks and channels and allow to revegetate

- Increase native ecosystem productivity and biodiversity
- Increase availability of sediment, woody material, nutrients for aquatic habitats
- Improve hydrological regimes
- Increase habitat complexity and diversity for aquatic life
- Improved sediment and nutrient transport and retention/recycling dynamics
- Improve thermal regimes and water quality
- Potentially increase base flow
- Restore dynamic channel boundary; allow natural avulsion (migration of channel) within floodplain

Improve stormwater storage and processing

- Increase native ecosystem productivity and biodiversity
- Restore natural hydrologic regime
- Reduce flashiness
- Improve water quality and thermal regimes
- Improve habitat complexity and diversity for aquatic life
- Reduce sources of pollutants (including excess fine sediment)

Enhance or restore riparian buffer

- Increase native ecosystem productivity and biodiversity
- Improve habitat complexity and diversity for aquatic life
- Improve thermal regimes and water quality
- Increase retention of woody material, sediment and nutrients
- Improve sediment and nutrient recycling

Install coarse woody material in stream/along banks

- Increase native ecosystem productivity and biodiversity
- Improve habitat complexity and diversity for aquatic life
- Improve thermal regimes and water quality
- Increase retention of wood, sediment and nutrients

- Improve sediment and nutrient recycling

Use Low Impact Development (LID) technology (pervious surfaces, rain gardens, filter strips, etc.)

- Increase native ecosystem productivity and biodiversity
- Restore natural hydrologic regime
- Improve water quality and thermal regimes
- Improve habitat complexity and diversity for aquatic life
- Reduce flashiness

Remove pavement and other impervious surfaces

- Increase native ecosystem productivity and biodiversity
- Improve hydrologic regime
- Improve water quality and thermal regimes
- Improve habitat complexity and diversity for aquatic life

Preserve natural banks and floodplains

- Preserve native ecosystem productivity and biodiversity
- Preserve availability of sediment, wood, nutrients for aquatic habitats
- Preserve hydrological regimes
- Preserve habitat complexity and diversity for aquatic life
- Preserve sediment and nutrient transport and retention/recycling dynamics
- Preserve thermal regimes and water quality

Determining Stream Debits/Credits

Unlike wetlands, streams require two matrices: one to calculate the credits required to compensate for various stream impacts (Table 4) and another to address the credits generated by various preservation, enhancement, and/or restoration projects (Table 5). Five ratio multipliers have been provided for each activity in order to compensate for varying stream conditions as determined using the Stream Visual Assessment Protocol Version 2 (SVAP2). The ratio multipliers are then multiplied by the length of stream (or stream bank) impacted by the project, to calculate the necessary credits required to compensate for the stream impacts. Best professional judgment should be used to complete the SVAP2 Worksheet and determine whether the stream in the area of the impact or mitigation project is currently Severely Degraded, Poor, Fair, Good, or Excellent. Multipliers should then be applied accordingly.

It should be noted that these tables assume that impacts are permanent. In general, for impacts not expected to last more than one year, mitigation is not recommended. For impacts expected to last more than one year but no more than two years, multiply the credits needed to provide appropriate compensation by 0.25.

Calculating Mitigation Credits Needed ("Debits"):

1. Complete the Stream Visual Assessment Protocol Worksheet.
2. Determine whether the stream to be impacted is Severely Degraded, Poor, Fair, Good, or Excellent.
3. For each Impact Activity associated with the project, determine the linear feet of direct impacts to the stream.
4. Using the appropriate multiplier, calculate the mitigation credits needed to compensate for each Impact Activity.
5. Calculate the total mitigation credits needed to compensate for the project impacts by adding all of the credits calculated in Step 4.

TABLE 4: RECOMMENDED COMPENSATORY MITIGATION MULTIPLIERS FOR STREAM IMPACTS TO DETERMINE CREDIT REQUIREMENTS

IMPACT ACTIVITY	MULTIPLIER				
	Severely Degraded	**Poor**	**Fair**	**Good**	**Excellent**
Culverting/piping/bridges not meeting Stream Crossing Standards	1	1.5	2	2.5	3
Utility crossing with disturbance of streambed. Since utility crossings are generally perpendicular to the bank, ratios are based on the length of the crossing from bank to bank (i.e. stream width). If the width of the crossing will exceed 12 LF (normal width of utility impacts) of stream, the ratio will generally need to be increased.	0.01	0.05	0.10	0.15	0.20
Impoundment[25] (fill for the dam or other structure is addressed in miscellaneous fill in stream)	0.5	1	1.5	2	3
Dredging/channel excavation (within existing stream alignment), assuming there is a discharge of dredged or fill material in S.404 waters to trigger jurisdiction or the work is in S.10 waters.	0.5	1.0	1.5	2.5	3

[25] Based on length of stream impounded. Fill for dam or whatever causes a constriction is addressed under "Fill". Note that flooded wetlands will be addressed as secondary wetland impacts.

Raising stream bed/lining stream channel (within existing stream alignment)	0.25	0.50	0.75	1.0	2
Stream Relocation	0.5	1.0	2	3	4
Bank armoring/bulkhead (assumes one bank; use double for both banks)	0.1	0.2	0.3	0.4	0.5
Clearing 100' from bank (assumes 1 bank; double for both banks)[26, 27] assuming there is a discharge of dredged or fill material in S.404 waters to trigger jurisdiction	0.1	0.2	0.3	0.4	0.5
Other miscellaneous fill in stream		Case-specific			
Other stream impacts		Case-specific			

Calculating Mitigation Credits Generated:

1. Complete the Stream Visual Assessment Protocol Worksheet.
2. Determine whether the stream to be modified is Severely Degraded, Poor, Fair, Good, or Excellent.
3. For each Form of Mitigation, determine the linear feet of proposed mitigation.
4. Use the appropriate multiplier to calculate the mitigation credits generated from each Form of Mitigation proposed.
5. Calculate the total mitigation credits the proposed mitigation would generate by adding all of the credits calculated in Step 4.

[26] This is when clearing includes removal of stumps in an upland; if is just cutting of all woody vegetation, a much smaller multiplier would be appropriate. Clearing involving removal of stumps in a wetland is a direct impact and is addressed in the Wetland Module.

[27] Assumes woody vegetation in upland is removed for the entire 100'. Prorate for less than 100'.

TABLE 5: RECOMMENDED COMPENSATORY MITIGATION RATIOS FOR STREAM CREDIT GENERATION

Starting Stream Condition / Form of Mitigation (all shown as credits/lf) — Mitigation types can be additive if more than one type of mitigation is being done to a length of stream.	Severely Degraded	Poor	Fair	Good	Excellent
Preservation - Additional credit may be granted if entire beltwidth, which is wider than 100' from the stream, is protected.	No credit (unless associated with enhancement to bring stream to fully functional conditions, in which case 0.25 for one side and 0.5 for both sides)	0.1 (one side) 0.2 (both sides)	0.25 (one side) 0.5 (both sides)	0.4 (one side) 0.8 (both sides)	Preservation of 100' unaltered (no forestry, agriculture, or other modifications) buffer: 0.5 (one side) 1.0 (both sides)
Daylighting/Elimination of fully lined channel	0.5	0.5	0.75	N/A	N/A
Removal of dams (measure streambed exposed when the impoundment is removed)	0.1	0.25	0.5[28]	0.75	N/A
Modifications to restore stream connectivity with its floodplain	0.1	0.2	0.3	0.4	N/A
Reestablishment of ≥25' riparian buffer of deep-rooted vegetation, typically trees and shrubs, along one bank (double for both banks)	0.1	0.1	0.15	0.25	N/A
Reestablishment of natural stream channel (formerly channelized/ditched in natural substrate)	0.3	0.5	N/A	N/A	N/A
Establishment of new stream channel for relocated stream	0.1	0.3	0.5	N/A	N/A
Installation of fish ladder (length of stream made accessible to migratory species)	0.01 – 1st 3 miles 0.005 - >3 – 10 miles	0.01 – 1st 3 miles 0.005 - >3 – 10 miles	0.01 – 1st 3 miles 0.005 - >3 – 10 miles	0.01 – 1st 3 miles 0.005 - >3 – 10 miles	N/A
Other e.g., coarse woody material, removal of riprap or other fill/debris, livestock exclusion, upgrade culvert to meet stream crossing standards, stormwater improvements/BMPs.	Case-specific	Case-specific	Case-specific	Case-specific	N/A

[28] If the dam is the only impediment on the reach, use the "Good" multiplier

STREAM MODULE CHECKLIST

NOTE: If the SVAP2 is used, some of these items may be addressed on that protocol's summary sheet.

I. Hydrology

1. [ ] Evidence of appropriate hydrology to support the desired stream type.
   a. [ ] Stream flow – ephemeral, intermittent, or perennial.
   b. [ ] Watershed size.
   c. [ ] Location in watershed.
2. [ ] Water source(s).
3. [ ] Salinity, if applicable.

II. Substrate

1. [ ] Substrate type. Indicate whether channel is a response or transport stream.
2. [ ] Proposed source of material.
3. [ ] Material size.

III. Structure and Stability

1. [ ] Plans show existing and proposed channel form.
   a. [ ] Cross section and profile.
   b. [ ] Channel width.
   b. [ ] Length of reach.
2. [ ] Sediment Transport Model.
3. [ ] Identify reference reach.

IV. Riparian Buffer Planting Plan

1. [ ] Plans use scientific names.
2. [ ] Plant materials are native and indigenous to the area of the site(s); invasive species, nonnative species, and/or cultivars are not proposed for planting or seeding.
3. [ ] Plan view drawings show proposed locations of planted stock.
4. [ ] Seed mix composition is provided
5. [ ] Relocation of plantings allowed when appropriate.
6. [ ] Other - Specific staff recommendations related to planting.

V. Coarse Woody Material and Other In-Stream Structures

1. [ ] Maintenance plan.
2. [ ] Appropriate amounts and location of coarse woody material are proposed.
3. [ ] Plan view showing approximate location of materials.

VI. Floodplains

1. [ ] Level of connectivity to floodplain.
2. [ ] Permanence of coarse woody material placed in floodplain.
3. [ ] Floodplain width

VII. Monitoring

1. [ ] Length of time and frequency of stream monitoring.
2. [ ] Adaptive management measures.
3. [ ] Maintenance measures.
4. [ ] Performance standards.

VIII. Other

1. [ ] Representative photos of the channel, banks, and side slopes.

STREAM MODULE CHECKLIST DIRECTIONS

I. HYDROLOGY

1. The expected seasonal depth, duration, and timing of stream flows should be described for the mitigation area. Indicate the stream type in terms of ephemeral, intermittent, or perennial. Indicate the watershed size and describe the location of the stream in the watershed.

2. The narrative for the mitigation describes water sources (groundwater, surface runoff, precipitation, lake and/or stream overflow, tidal, and/or springs and seeps). Provide substantiation (e.g., well data, adjacent wetland conditions, stream gauge data, precipitation data) if available.

3. Salinity information for coastal streams may be needed on a case-by-case basis.

II. SUBSTRATE

1. Describe the naturally occurring substrate in reference reaches.

2. Only clean material shall be used to construct the mitigation site. Provide information on the source and the likelihood the material contains any contaminants or invasive species seeds. Stone to be used for the mitigation site should be washed prior to placement in waters.

3. Stone used in the mitigation site should be adequately sized to withstand high flows. Information on material size and source should be indicated on the mitigation plan.

III. STRUCTURE AND STABILITY

1. Existing and proposed channel form shall be provided for the mitigation site. Stream profiles and cross sections must be included in the plans. Indicate active channel width based on Ordinary High Water Mark (OHWM) and length of reach. Extend the linear profile at least 25' above and below the reach on which work is proposed. OHWM must be clearly labelled on all plans.

2. Sediment Transport Models should be provided if applicable.

3. Reference reaches shall be identified and indicated on the SVAP2 worksheet and used to determine appropriate sinuosity, gradients, slopes, etc. Note that it is important to research the history of the reference reach if it is to be used as a

template for construction to ensure that it is actually a natural, highly functioning system that is not in disequilibrium from human impacts.

IV. RIPARIAN BUFFER PLANTING PLAN

1. The use of scientific names ensures that all involved have the correct understanding of the species of plants proposed to be planted or seeded.

2. During the first few years while the designed vegetative zones become established, they are susceptible to colonization and subsequent domination by invasive species. A number of plants are known to be especially troublesome in this regard. The following stipulation shall be included in the mitigation plan, either in the plan view or in the narrative portion of the plan:

➡ To reduce the immediate threat and minimize the long-term potential of degradation, the species included on the "Invasive and Other Unacceptable Plant Species" list in Appendix C of the New England District Mitigation Plan Guidance shall not be included as planting stock in the overall project. Only plant materials native and indigenous to the region shall be used (with the exception of **[specify]**). Species not specified in the mitigation plan shall not be used without prior written approval from the Corps.

3. A plan view drawing should show where the various species are proposed to be planted. Since showing each individual plant is neither practical nor realistic, this may be illustrated with areas of uniform species (may include several species) composition and the number of plants or rate of seeding within the polygon. The scale should be in the range of 1"=20' to 1"=100', depending on the size of the site.

4. The list of species proposed in seed mixes should not include any species in the list of invasives in Appendix C. Similarly, non-native genotypes and cultivars should not be used.

5. The following stipulation shall be included in the mitigation plan, either in the drawings or in the narrative portion of the plan:

➡ During planting, a qualified professional may relocate up to 50 percent of the plants if as-built site conditions would pose an unreasonable threat to the survival of plantings installed according to the mitigation plan. The plantings shall be relocated to locations with suitable hydrology and soils and where appropriate structural context with the stream can be maintained.

V. COARSE WOODY MATERIAL AND OTHER IN-STREAM FEATURES

1. If in-stream structures (rock weirs, J-hooks, cross vanes, etc.) are proposed in the mitigation site, a statement addressing long-term maintenance shall be included

on the plan. Man-made features may fail and cause unintended consequences. A remedial plan should be included in the event of failure.

2. The following language must be included in the mitigation plan, either in the drawings or in the narrative portion of the plan:

- A supply of appropriately sized coarse woody material (X structures/50 linear feet) shall be installed throughout the mitigation site to provide in stream habitat. These materials should not include species shown on the list of invasive species (Appendix C) in the New England District Mitigation Plan Guidance unless they are clearly dead and include no fruits/seeds.

3. A plan view drawing should show where the CWM may be placed. Depending on the size of the mitigation site, showing each individual specimen may not be practical or realistic and may be illustrated with areas of uniform species composition and number.

VI. FLOODPLAINS

1. Describe the degree of connectivity of the stream to its floodplain. Indicate whether natural or manmade berms are present, if hard armoring has occurred along banks, and the level of development in the floodplain.

2. If a supply of dead or dying material will be included in the floodplain zone, indicate how the material will be anchored to prevent washing away during high flows.

VII. MONITORING

1. Monitoring will generally take place for 10 years (years 1, 2, 3, 5, 7, and 10).

2. Adaptive management measures may be needed in the event of unforeseen problems/site failures, including the effects of climate change.

3. Maintenance is critical in the overall long term success of mitigation projects.

4. Clearly defined enforceable performance standards must be established.

APPENDIX H

OTHER AQUATIC RESOURCES MODULE

OTHER AQUATIC RESOURCES MODULE DISCUSSION

This module includes other aquatic resources for which we have yet to develop more detailed resource-specific guidance, such as mud flats and open water.

TABLE 6 - RECOMMENDED COMPENSATORY MITIGATION RATIOS FOR DIRECT PERMANENT IMPACTS TO OPEN WATER AND MUD FLATS

Mitigation / Impacts	Restoration (re-establishment)	Creation (establishment)	Rehabilitation	Preservation (protection/ management)
Open Water	1:1	1:1	project specific[29]	20:1
Mudflat	3:1	3:1	project specific	20:1

[29] Might include planting submerged and/or floating aquatics and/or removal of invasive species.

APPENDIX I

INVASIVE AND OTHER UNACCEPTABLE PLANT SPECIES[30]

a. Herbs:

Aegopodium podagraria	Goutweed or Bishop's weed
Aira caryophyllea	Silver hairgrass
Alliaria petiolata	Garlic mustard
Allium vineale	Field garlic
Ampelopsis brevipedunculata	Porcelain berry
Anthoxanthum odoratum	Sweet vernal grass
Anthriscus sylvestris	Chervil
Arctium minus	Common burdock
Arthraxon hispidus	Hairy joint grass
Asparagus officinalis	Asparagus
Barbarea vulgaris	Yellow rocket
Bassia scoparia (*Kochia scoparia*)	Summer cypress
Bromus tectorum	Drooping brome-grass
Butomus umbellatus	Flowering rush
Cabomba caroliniana	Fanwort
Callitriche stagnalis	Water-starwort
Calystegia sepium	Japanese bindweed
Cardamine impatiens	Bushy rock-cress
Cardamine pratensis	Cuckoo-flower
Carex kobomugi	Japanese sedge
Centaurea stoebe ssp. *micranthos* (*C. biebersteinii*)	Spotted knapweed
Chelidonium majus	Celandine
Cirsium arvense	Canada-thistle
Cirsium palustre	Marsh thistle
Commelina communis	Asiatic day-flower
Cynanchum louiseae (*Vincetoxicum nigrum*)	Black swallow-wort
Cynanchum rossicum (*Vincetoxicum rossicum*)	Black swallow-wort
Cyperus esculentus	Yellow nutsedge
Dactylis glomerata	Orchard-grass
Datura stramonium	Jimsonweed
Echinochloa crus-galli	Barnyard grass
Egeria densa	Giant waterweed
Eichhornia crassipes	Water hyacinth
Eleusine indica	Goosegrass

[30] Scientific names are those used primarily in National Wetland Plant List (http://wetland_plants.usace.army.mil/) and secondarily in USDA PLANTS database (http://plants.usda.gov/).

Elsholtzia ciliata	Elsholtzia
Elymus repens (*Elytrigia repens*)	Quack-grass
Epilobium hirsutum	Hairy willow-herb
Euphorbia cyparissias	Cypress spurge
Euphorbia esula	Leafy spurge
Fallopia baldschuanica (*Polygonum baldschuanicum*, *P. aubertii*)	Silver lace-vine
Fallopia japonica (*Polygonum cuspidatum*)	Japanese knotweed
Fallopia sachalinensis (*Polygonum sachalinense*)	Giant knotweed
Festuca trachyphylla (*F. ovina*, *F. brevipila*)	Sheep fescue
Ficaria verna (*Ranunculus ficaria*)	Lesser celandine
Froelichia gracilis	Slender snake cotton
Geranium ibericum	Nepalese crane's-bill
Geranium sibiricum	Siberian crane's-bill
Geranium thunbergii	Thunberg's geranium
Glaucium flavum	Sea- or horned poppy
Glechoma hederacea	Gill-over-the-ground
Glyceria maxima	Sweet reedgrass
Hemerocallis fulva	Tiger-lily
Heracleum mantegazzianum	Giant hogweed
Hesperis matronalis	Dame's rocket
Hydrilla verticillata	Hydrilla
Hydrocharis morsus-ranae	European frog-bit
Hylotelephium telephium (*Sedum telephium*)	Live-forever or Orpine
Hypericum perforatum	St. John's wort
Impatiens glandulifera	Ornamental jewelweed
Iris pseudacorus	Yellow iris
Lamium spp. (all)	Dead nettle
Lepidium latifolium	Tall pepperwort
Leptochloa panicea	Hair fescue
Lotus corniculatus	Birdsfoot trefoil
Luzula luzuloides	Oakforest woodrush
Lychnis flos-cuculi	Ragged robin
Lysimachia nummularia	Moneywort
Lysimachia vulgaris	Garden loosestrife
Lythrum salicaria	Purple loosestrife
Malva neglecta	Cheeses or common malva
Marsilea quadrifolia	Water shamrock or Eurasian water clover
Mentha arvensis	Field-mint
Microstegium vimineum	Japanese stilt-grass
Miscanthus sinensis	Eulalia
Myosotis scorpioides	True forget-me-not
Myosoton aquaticum	Giant chickweed
Myriophyllum aquaticum	Parrot feather

Myriophyllum heterophyllum	Variable water-milfoil
Myriophyllum spicatum	Eurasian water-milfoil
Najas minor	Lesser naiad
Nasturtium microphyllum (*Rorippa microphylla*)	One-row yellow cress
Nasturtium officionale (*Rorippa nasturtium-aquaticum*)	Watercress
Nymphoides peltata	Yellow floating heart
Onopordum acanthium	Scotch thistle
Ornithogalum umbellatum	Star of Bethlehem
Pachysandra terminalis	Japanese spurge
Pastinaca sativa	Wild parsnip
Persicaria maculosa (*Polygonum persicaria*)	Lady's thumb
Persicaria perfoliata (*Polygonum perfoliatum*)	Mile-a-minute vine
Persicaria posumbu (*Polygonum caespitosum*)	Cespitose knotweed
Phalaris arundinacea	Reed canary-grass
Phragmites australis	Reed grass, Phragmites
Pistia stratiotes	Water lettuce
Poa compressa	Canada bluegrass
Poa pratensis	Kentucky bluegrass
Poa trivialis	Rough bluegrass
Potamogeton crispus	Curly pondweed
Puccinellia maritima (*P. americana*)	Seaside alkali-grass
Pueraria montana	Kudzu
Ranunculus repens	Creeping buttercup
Rorippa amphibia	Great yellow cress
Rorippa sylvestris	Creeping yellow cress
Rumex acetosella	Sheep-sorrel
Rumex obtusifolius	Bitter dock
Salvinia molesta	Salvinia
Securigera varia (*Coronilla varia*)	Crown vetch
Senecio jacobaea	Tansy ragwort
Setaria pumila (*S. lutescens, S. glauca*)	Yellow foxtail or yellow bristlegrass
Silphium perfoliatum	Cup plant
Solanum dulcamara	Bittersweet nightshade
Stellaria graminea	Common stitchwort
Tanacetum vulgare	Tansy
Thymus pulegioides	Wild thyme
Trapa natans	Water-chestnut
Tussilago farfara	Coltsfoot
Typha angustifolia	Narrow-leaved cattail
Typha latifolia[31]	Common or Broad-leaved cattail
Typha X glauca	Hybrid cattail

[31] *Typha* spp. are native species which provide good water quality renovation and other functions/values. However, they are aggressive colonizers which, given the opportunity, will preclude establishment of other native species. They are included in this list as species not to be planted, not because they are undesirable in an established wetland, but to provide opportunities for other species to become established. It is likely they will eventually move in without human assistance.

Valeriana officinalis	Garden heliotrope
Verbascum thapsus	Common mullein
Veronica beccabunga	European speedwell
Xanthium strumarium	Common cocklebur

b. Woody Plants:

Acer ginnala	Amur maple
Acer platanoides	Norway maple
Acer pseudoplatanus	Sycamore maple
Actinidia arguta	Kiwi vine
Ailanthus altissima	Tree-of-heaven
Alnus glutinosa	European alder
Amorpha fruticosa	False indigo
Berberis thunbergii	Japanese barberry
Berberis vulgaris	Common barberry
Buddleja davidii	Butterfly bush
Catalpa speciosa	Western catalpa
Celastrus orbiculatus	Oriental bittersweet
Cytisus scoparius	Scotch broom
Elaeagnus angustifolia	Russian olive
Elaeagnus umbellata	Autumn olive
Euonymus alatus	Winged euonymus
Euonymus hederaceus (*E. fortunei*)	Climbing euonymus
Frangula alnus (*Rhamnus frangula*)	European buckthorn
Humulus japonicus	Japanese hops
Hypericum prolificum	Shrubby St. John's wort
Ligustrum obtusifolium	Japanese privet
Ligustrum ovalifolium	California privet
Ligustrum sinense	Chinese privet
Ligustrum vulgare	Common/hedge privet
Lonicera japonica	Japanese honeysuckle
Lonicera maackii	Amur honeysuckle
Lonicera morrowii	Morrow's honeysuckle
Lonicera tatarica	Tatarian honeysuckle
Lonicera X bella	Morrow's X Tatarian honeysuckle
Lonicera xylosteum	European fly-honeysuckle
Morus alba	White mulberry
Paulownia tomentosa	Princess tree or empress tree
Phellodendron amurense (*P. japonicum*)	Corktree
Populus alba	Silver poplar
Rhamnus cathartica	Common buckthorn
Ribes rubrum (*R. sativum*)	Garden red currant
Robinia pseudoacacia	Black locust
Rosa multiflora	Multiflora rose

Rosa rugosa	Rugosa rose
Rubus phoenicolasius	Wineberry
Salix purpurea[32]	Basket or purple-osier willow
Sorbus aucuparia	European mountain-ash
Taxus cuspidata	Japanese yew
Ulmus pumila	Siberian elm
Wisteria floribunda	Wisteria

[32] This is not appropriate for use in wetland mitigation. In some circumstances it may be appropriate in stream bank stabilization.

APPENDIX J

MITIGATION REPORT TRANSMITTAL AND SELF-CERTIFICATION

DEPARTMENT OF THE ARMY PERMIT NUMBER:
PROJECT TITLE:

PERMITTEE:
MAILING ADDRESS:

TELEPHONE:

AUTHORIZED AGENT:
MAILING ADDRESS:

TELEPHONE:

ATTACHED MITIGATION REPORT
TITLE:

PREPARERS:

DATE:

CERTIFICATION OF COMPLIANCE: I certify that the attached report is accurate and discloses that the mitigation required by the Department of the Army Permit **[is] [is not]** in full compliance with the terms and conditions of that permit.

CORRECTIVE ACTION: A need for corrective action **[is] [is not]** identified in the attached report.

CONSULTATION: I **[do] [do not]** request consultation with the Corps of Engineers to discuss a corrective strategy or permit modification.

CERTIFIED:_____
(Signature of permittee) Date

APPENDIX K

MITIGATION REPORT
PROJECT OVERVIEW FORM

Corps Permit No.:
Mitigation Site Name(s):
Monitoring Report: _____ of _____
Name and Contact Information for Permittee and Agent:

Name of Party Responsible for Conducting the Monitoring:

Date(s) of Inspection(s):

Project Summary:

[include purpose of approved project, acreage and type of aquatic resources impacted, and mitigation acreage and type of aquatic resources authorized to compensate for the aquatic impacts]

Location of and Directions to Mitigation Site(s):

Start and Completion Dates for Mitigation:

Performance Standards **are**/**are not** being met:

[describe how]

Dates of Corrective or Maintenance Activities Conducted Since Last Report:

Recommendations for Additional Remedial Actions:

APPENDIX L

US Army Corps of Engineers – New England District
Vernal Pool Assessment

Vernal Pool Definition:

Vernal pools are depressional aquatic resource basins that typically go dry in most years and may contain inlets or outlets, typically of intermittent flow. Vernal pools range in both size and depth depending upon landscape position and parent material(s). Pools usually support one or more indicator species, including: wood frog, spotted salamander, blue-spotted salamander, marbled salamander, Jefferson's salamander, and fairy shrimp; however, they should preclude sustainable populations of predatory fish.

Vernal Pool Assessment:

This vernal pool rapid assessment method is designed to characterize vernal pools and to provide a valuation for features of the pool and surrounding habitat for regulatory purposes – impact and compensatory mitigation assessment. Since characteristics of vernal pools vary considerably and in turn can lead to varying functions and levels of functions among different pools, this methodology is designed to offer a simplified approach to assessing and comparing key features of these highly variable aquatic systems. In addition, it can provide a basis for developing appropriate compensatory mitigation for impacts to vernal pools. As each vernal pool or vernal pool complex is unique, the Corps should be consulted prior to developing any specific sampling protocol to ensure that all the necessary data are collected without an over-expenditure of time and resources. Data should be submitted on the Corps of Engineers – New England District "Vernal Pool Characterization Form."

The data collected for assessing vernal pools should be acquired during site visits conducted during the appropriate season(s) (e.g., early spring for egg mass counts, early summer for presence of metamorphs, etc.). When examining for egg masses, the entire pool should be comprehensively surveyed. A minimum of one year's data is recommended, but two to three years' data is encouraged to account for variations in reproductive effort, and hydrologic and climatologic conditions. In particular, for large projects that undergo many years of planning, it is highly recommended that vernal pool resources be identified in the initial planning phases to allow for collection of multiple seasons' worth of site data on any vernal pools present. When abilities to visit and survey the pools are limited to non-optimal times of the year, documentation of the Vernal Pool Characteristics and Vernal Pool Envelope

and Critical Habitat Area Characteristics may be useful in determining the presence of vernal pools and their potential level of functioning.

Physical characteristics of some pools may be relatively stable, while these same characteristics (e.g., depth, vegetation, substrate, etc.) may vary in others. Such variations in pool characteristics can be accounted for through careful observations and record keeping during site visits. Timing of site visits is crucial to capture the appropriate seasons for sampling. The start of the amphibian breeding season may vary by several weeks from year to year, based on temperature, pool ice cover, and other climatic conditions. In addition to the climatic conditions, the breeding season varies geographically from southern New England to northern New England.

To appropriately document faunal usage of pools, repeated visits may be required during different seasons. For instance, some species may require more intensive sampling efforts in comparison to other species when determining presence/absence. Early spring visits are needed to conduct egg mass surveys, while later visits can identify metamorphs and determine reproductive success via the number of metamorphs leaving prior to drying. If deemed appropriate, studies within the vernal pool envelope and critical habitat areas can identify migratory pathways of the pool-breeding amphibians. This can also identify the portions of the surrounding landscape (especially in the vernal pool envelope / critical terrestrial habitat) that are being utilized by particular pool-breeding amphibians.

Predators such as fish and bullfrog and green frog larvae have been shown to consume the egg masses and larvae of vernal pool-breeding amphibian species, and have the potential to lessen or cause complete reproductive failure when present in high densities. PLEASE NOTE: The specific combination of indicator and predator species present may have variable impact on the reproductive success of a given indicator species (e.g., the presence of green frog tadpoles may have little or no impact on the reproductive success of spotted salamanders). Therefore, it is important to note the presence/absence and relative abundance of predators. Enough information should be gathered to differentiate sustainable, resident predator populations from smaller, unsustainable or transient groups that will not have as great an impact on vernal pool indicator species. In a pool with high predator densities, it is especially recommended that egg mass counts of vernal pool indicator species be supplemented with larval dip-net sampling or amphibian trapping during the summer and fall months to document larval development and to provide insight on reproductive success.

<u>Vernal Pool Characterization Form Instructions</u>:

To document how a pool functions within its landscape, a Vernal Pool Characterization Form should be completed for each pool assessed. Additional

notes, drawings, and photographs (of the pool and surrounding habitat) are encouraged to supplement this form. Aerial photographs of the pool and surrounding landscape (e.g., from Google Earth©) should also be attached. We recommend doing a complete survey of the project area for vernal pools, as far in advance as possible.

The Vernal Pool Characterization Form is divided into three separate sections: vernal pool characteristics, vernal pool envelope and critical terrestrial habitat characteristics, and observed species present. THE VALUATION SCORES ARE TOTALLED SEPARATELY FOR EACH OF THE FIRST TWO SECTIONS. DO NOT COMBINE THESE TWO SCORES INTO A SINGLE SCORE. THE THIRD SECTION DOES NOT RECEIVE A SCORE, ONLY PRESENCE/ABSENCE.

The numbers to the right of the checkbox descriptions on this form are the values used to score the features of the vernal pool being evaluated. If there is "NA" or blank space instead of a number next to the checkbox, this feature is used for overall characterization purposes; however, it is not used to value the pool and the box should only be checked if present. For each section, the numbers are totaled for all boxes checked (NA and scoreless boxes are not included) and included at the bottom of the section. Typically, one box per topic will be checked. Under the "Vernal Pool Envelope and Critical Habitat Area Characteristics" (items B.1 and B.2., respectively) multiple items may be checked if the surrounding land use is not homogeneous. In this case, each scored number is related to the percentage of that land use in the vernal pool envelope. For example, if all of the land in the vernal pool envelope is forested, it gets a value of 16. However, if only 50% is forested, this portion gets an 8 (50% of 16) and the remainder gets whatever portion it encompasses (e.g., if the remaining 50% is "open," it gets a score of 2 and this item gets a total score of 10). It should also be noted under B.1 and B.2 if one or more barriers to migration are present within these zones. These barriers may be natural (e.g., river, lake) or human-made (e.g., large highway), but effectively prevent the vernal pool fauna from crossing to utilize the habitat beyond. If one or more barriers are present, the percentage of the zone that is beyond the barrier(s) should be noted and the remaining percentage of landuse types should be completed for the portion of the zone which is accessible from the pool.

Section C documents the presence/absence of species. "Few/common/many" is used for quantifying the non-indicator species present in the pool. Best professional judgment should be used in applying these terms as the actual numbers for each will vary with the type of organisms documented.

Determining Compensatory Mitigation for Vernal Pool Impacts:

The following method is the typical way to determine compensatory mitigation for vernal pool impacts. Different methods may be used on a case-by-case basis where specific information (e.g., vernal pool organism migratory

pathways) is adequately documented. For direct impacts to the pool itself, compensatory mitigation amounts should be based on the recommended ratios for the wetland type (e.g., forested, scrub-shrub) impacted, found in Table 1 – Recommended Compensatory Mitigation Ratios for Direct Permanent Impacts, found in the New England District Compensatory Mitigation Guidance, plus the vernal pool impact factor (below). For secondary impacts to the vernal pool due to loss or disturbance of the envelope and/or critical habitat, compensatory mitigation is the vernal pool impact factor, which may be calculated from the difference in pre and post project scores for B.1 and B.2:

$$\frac{\{[(A.1 + A.4 + A.8.a + A.8.b)pre - (A.1 + A.4 + A.8.a + A.8.b)post]*60\}}{28} + \frac{\{[(B.1 + B.2)pre - (B.1 + B.2)post]*60\}}{32} =$$

vernal pool impact factor

A.1 – points for landscape setting
A.4 – points for aquatic resource type
A.8.a – points for hydroperiod
A.8.b – points for inlet/outlet
(A.1 + A.4 + A.8.a + A.8.b)pre - the total points prior to impacts
(A.1 + A.4 + A.8.a + A.8.b)post - the remaining points after impacts
28 – the maximum points possible for A.1 + A.4 + A.8.a + A.8.b
B.1 – points for the landuse type within the 100-ft vernal pool envelope
B.2 – points for the landuse type within the 100 - 750-ft vernal pool critical terrestrial habitat
(B.1 + B.2)pre – the total points prior to impacts
(B.1 + B.2)post – the remaining points after impacts
32 – the maximum points possible for B.1 + B.2
60 – the multiplier, based on maximum pool values of 60

This method yields the amount of mitigation credit necessary to compensate for vernal pool impacts (often acreage to preserve). Specific ways of meeting those credits may be established by individual In-Lieu Fee programs or on a project-specific basis.

Checklist for Submissions:

_____ Vernal Pool Characterization Form
_____ Sketch of pool and surrounding habitat
_____ Pool and surrounding habitat photographs
_____ Aerial photographs
_____ Additional notes, including description of sampling methods

US Army Corps of Engineers - New England District
DRAFT Vernal Pool Characterization Form

Project File # _____ Project Name _____ Pool ID _____
Observer _____ Phone or E-mail _____
Landowner/Applicant _____ Phone or E-mail _____
Address _____ City _____ State _____ Zip _____
Location of vernal pool: City/State _____
Survey date(s) _____
Longitude/Latitude (in decimal degrees) _____

A. VERNAL POOL CHARACTERISTICS (fill in all information known):

1. Landscape setting (check all that apply):

☐ Upland depression (4 pts; if this is also in a floodplain, use 2 pts) ☐ Pool part of wildlife corridor (4 pts)

☐ Pool part of a pool complex (within 1000 feet of one or more other vernal pools) (NA)

☐ Pool within larger wetland system (4 pts; if this is also in a floodplain, use 2 pts) ☐ Other:_____(variable pts)

2. Vernal pool condition:

Describe any recent modifications to the pool and associated landscape: _____

_____

3. Parent material:

☐ Glacial fluvial ("outwash") ☐ Loose till ☐ Peat

☐ Dense till ☐ Alluvium ☐ Coastal marine sediments

4. Aquatic resource type that best applies to this pool (choose dominant):

☐ Forested wetland (4 pts) ☐ Herbaceous wetland (4 pts) ☐ Floodplain (overflow/oxbow) (3 pts)

☐ Shrub wetland (4 pts) ☐ Open water (2 pts) ☐ Other:_____(variable points)

☐ Peatland (acidic fen or bog) (4 pts) ☐ Intermittent stream reach (2 pts)

5. Pool canopy cover (%): _____

6. Predominant substrate:

☐ Mineral soil

☐ Organic matter (peat/muck) Depth _____ Sampling location (e.g., deepest zone, edge, etc.)_____

7. Pool size:

a. Approximate dimensions of pool (at maximum capacity; include units): Length _____ Width _____

Area: _____

b. Maximum depth at deepest point at time of survey (include units): _____

8. Hydrology:

a. Estimated hydroperiod (unless actual, observed hydroperiod value(s) is(are) known, use the presence of these example indicator species to best predict the expected hydroperiod of the pool):

☐ Dries between early March and early July (e.g., *Thelypteris palustris, Carex stricta, Impatiens capensis, Ilex verticillata*) (6 pts)

☐ Dries between early July and early September (e.g., *Sagittaria latifolia, Scirpus cyperinus, Dulichium arund., Cephalanthus occ.*) (8 pts)

☐ Dries between early September and early November (e.g., *Eleocharis palustris, Glyceria cana., Utricularia* spp., *Decodon vert.*) (8 pts)

☐ Dries between early November and late December, or intermittently exposed (e.g., *Nuphar* spp., *Potamogeton* spp.) (2 pts)

b. Inlet/outlet (pick one):

☐ No inlet/outlet (8 pts) ☐ Permanent inlet or outlet (channel with well-defined banks and permanent flow) (2 pts)

☐ Temporary inlet/outlet (6 pts)

9. Water quality:

☐ Clear ☐ High turbidity ☐ High algae content ☐ Tannic

_____ **TOTAL for Pool Characteristics (out of 28 max.)**

B. VERNAL POOL ENVELOPE (100 ft) AND CRITICAL HABITAT AREA (100-750 ft) CHARACTERISTICS (fill in all information known):

1. Landuse type and approximate percentage within the 100-ft vernal pool envelope:

☐ Forested _____% (16 pts) ☐ Open (e.g., meadow, agriculture, golf course)_____% (4 pts)

☐ Shrub _____% (10 pts) ☐ Developed _____% (0 pts)

2. **Landuse type and approximate percentage within the 100 - 750-ft vernal pool critical terrestrial habitat:**

☐ Forested _____% (16 pts) ☐ Open (e.g., agriculture, golf course)_____% (4 pts)

☐ Shrub _____% (10 pts) ☐ Developed _____% (0 pts)

☐ Are there one or more barriers to vernal pool fauna movement within the envelope and/or critical terrestrial habitat? If so, check here and see directions for explanation of how to incorporate this information.

Based on: ☐ Field estimate ☐ GIS ☐ Aerial photo estimate

_____ **TOTAL for Pool Envelope and Critical Terrestrial Habitat Area (out of 32 max.)**

C. SPECIES PRESENT IN VERNAL POOL

INDICATOR SPECIES	**DATE**	**EGG MASSES (#)**	**TADPOLES/LARVAE**
Wood Frog (*Lithobates sylvaticus*)			
Spotted Salamander (*Ambystoma maculatum*)			
Blue-spotted Salamander (*Ambystoma laterale*)			
Jefferson's Salamander (*Ambystoma jeffersonianum*)			
Marbled Salamander (*Ambystoma opacum*)			
Fairy Shrimp (*Eubranchipus* spp.)		**PRESENT/ABSENT**	**ABUNDANCE:**
OTHER SPECIES	**DATE**	**PRESENCE/ABSENCE**	**FEW/COMMON/MANY**
Facultative Species (e.g., Spring Peeper (*Pseudacris crucifer*), Gray Tree Frog (*Hyla versicolor*), Caddisflies (Limnephilidae, Phryganeidae), American Toad (*Anaxyrus americanus*), Eastern Spadefoot Toad (*Scaphiopus holbrookii*), Fowler's Toad (*Anaxyrus fowleri*), Fingernail Clams (Sphaeriidae, Pisidiidae))(list): _____ _____ _____			
Rare Species (list): _____ _____			
Predator Species (e.g., Bullfrog/Green frog tadpoles, Fish) (list): _____			
Other species (e.g., Ducks, Turtles, etc.)(list): _____ _____			

Presence of Indicator Species ☐ Yes ☐ No

SUMMARY:

_____**TOTAL for Pool Characteristics** _____ **TOTAL for Pool Envelope and Critical Terrestrial Habitat Area**

Other comments (append photographs, additional notes, sketch of pool and surrounding landscape):